Economic feasibility of pesticide use reduction in the arable sector:

Evidence from the French DEPHY farm network

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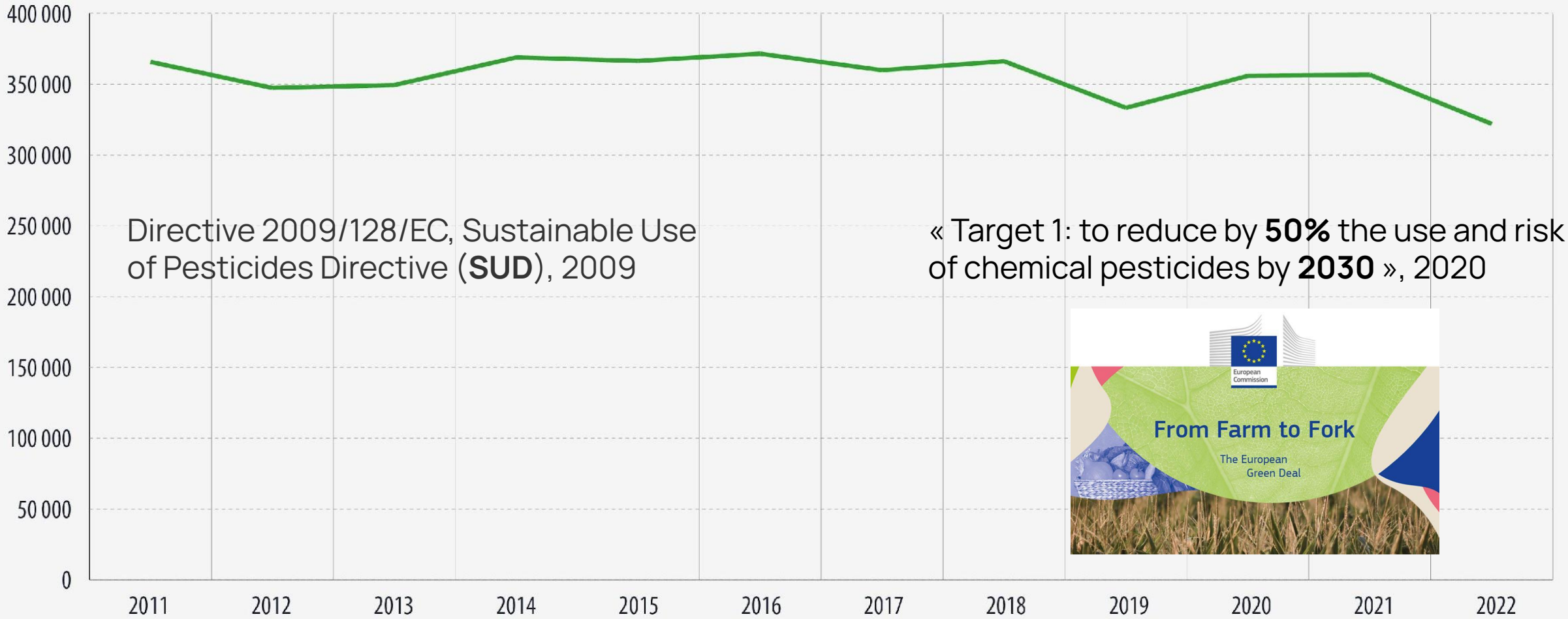
Pesticide sales in the EU, 2011-2022

(in tonnes)



Directive 2009/128/EC, Sustainable Use of Pesticides Directive (**SUD**), 2009

« Target 1: to reduce by **50%** the use and risk of chemical pesticides by **2030** », 2020

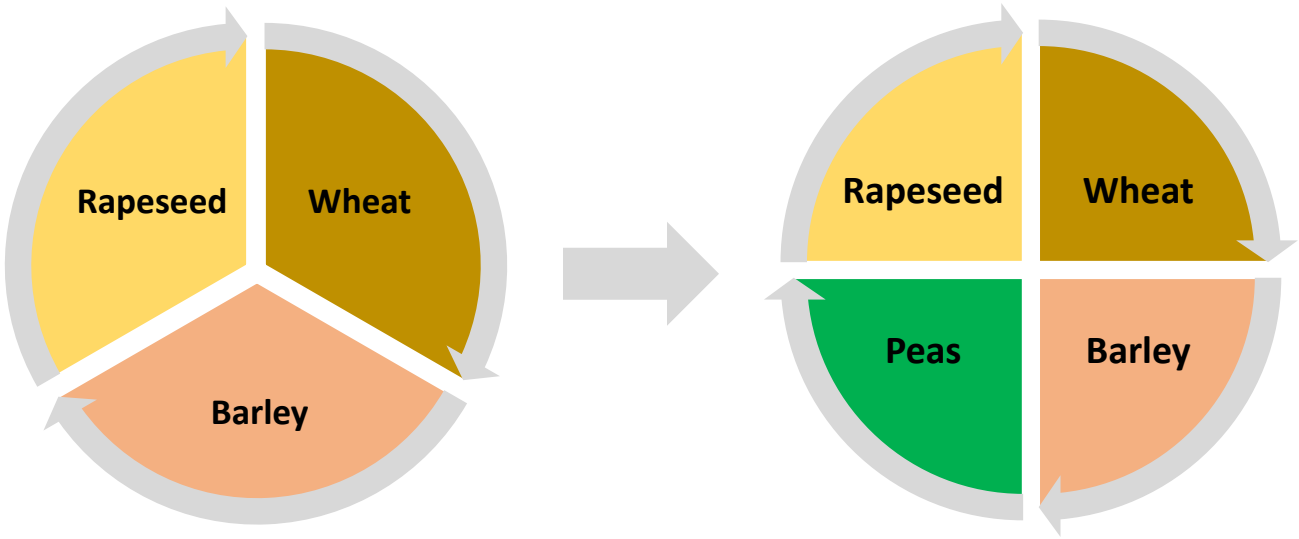
What explains this limited progress ?

- The lack of evidence on the large scale agronomic feasability
- The risk aversion to economic loss in farms
- The fear of the possible consequences on agricultural productivity and food sovereignty

Bjørnåvold et al., 2022
Hossard et al., 2017
Guichard et al., 2017

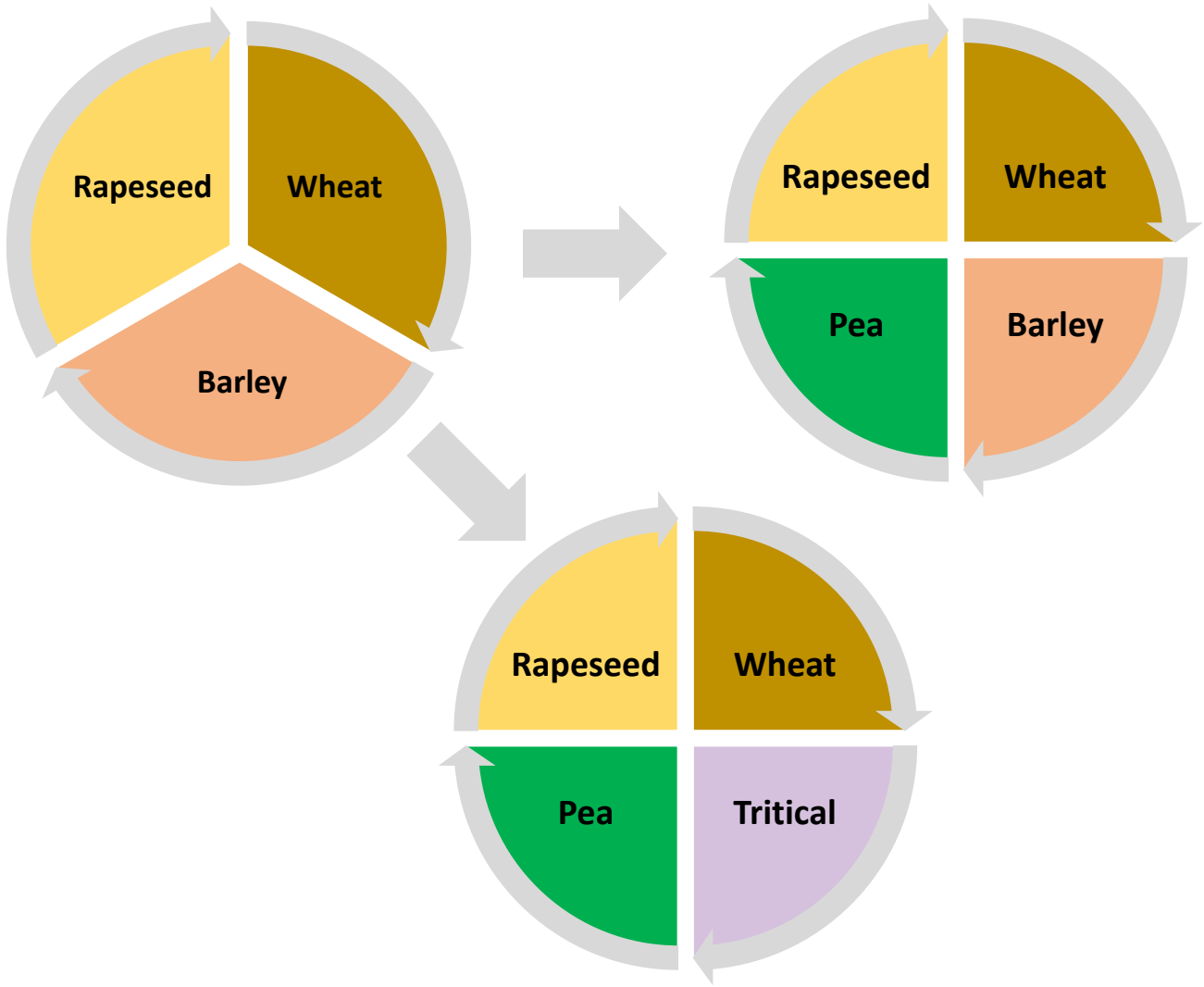
Agronomic feasibility of pesticide use reduction

- Crop diversification
  - Longer crop rotations



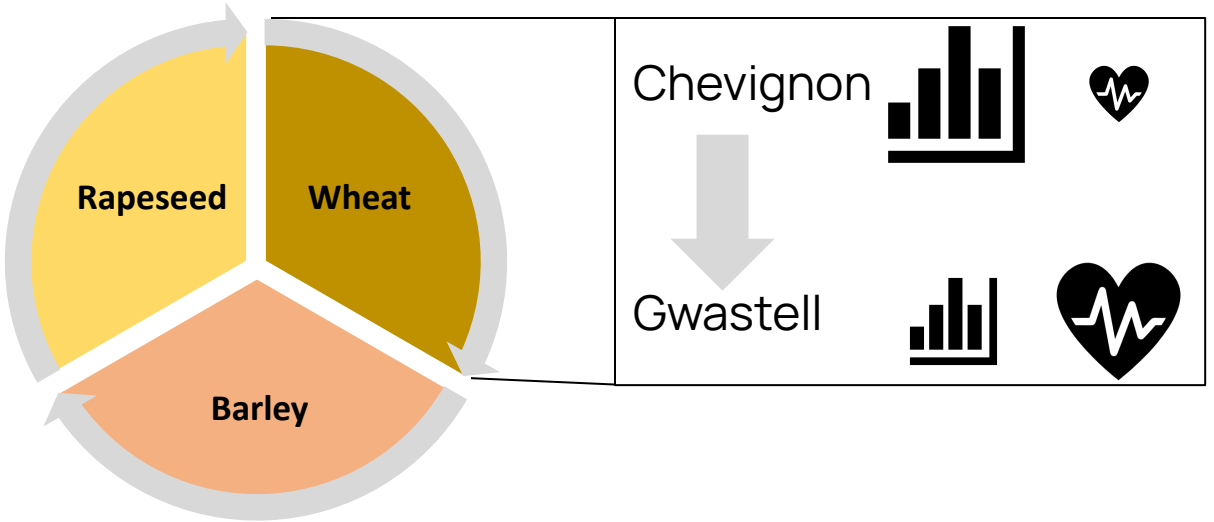
Agronomic feasibility of pesticide use reduction

- Crop diversification
  - Longer crop rotations
  - Introduction of more robust crops



Agronomic feasibility of pesticide use reduction

- Crop diversification
  - Longer crop rotations
  - Introduction of more robust crops
  - Use of hardier cultivars



Different wheat cultivars @ INRAE

Agronomic feasibility of pesticide use reduction

- Crop diversification
  - Longer crop rotations
  - Introduction of more robust crops
  - Use of hardier cultivars
- Moderation of fertilization

Organic fertilizers @ INRAE

Agronomic feasibility of pesticide use reduction

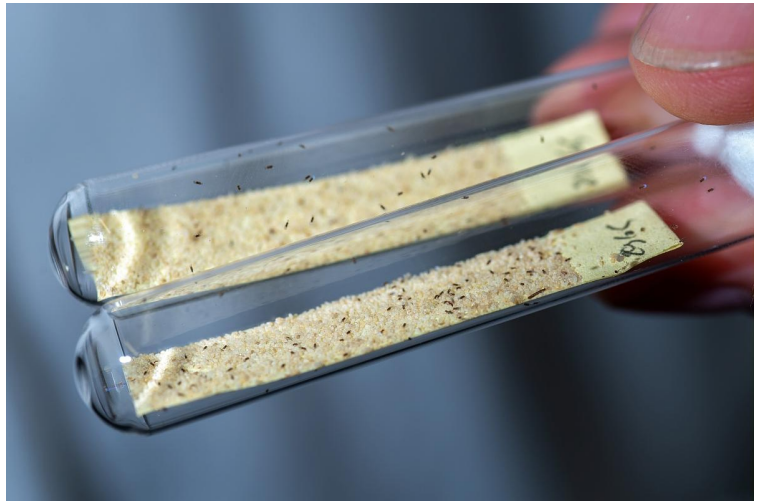
- Crop diversification
  - Longer crop rotations
  - Introduction of more robust crops
  - Use of hardier cultivars
- Moderation of fertilization
- Tillage & mechanical weeding

Mechanical weeding in maize @ INRAE

Agronomic feasibility of pesticide use reduction

- Crop diversification
  - Longer crop rotations
  - Introduction of more robust crops
  - Use of hardier cultivars
- Moderation of fertilization
- Tillage & mechanical weeding
- Biocontrol

Much more efficient when combined



Trichogramma @ INRAE

Damage caused by corn borer on maize @ INRAE

-20% on average
24% of the farms by more than **50%**
Nandillon et al., 2024

Chikowo et al., 2009
Bürger et al., 2012
Lechenent et al., 2016
Nandillon et al., 2024

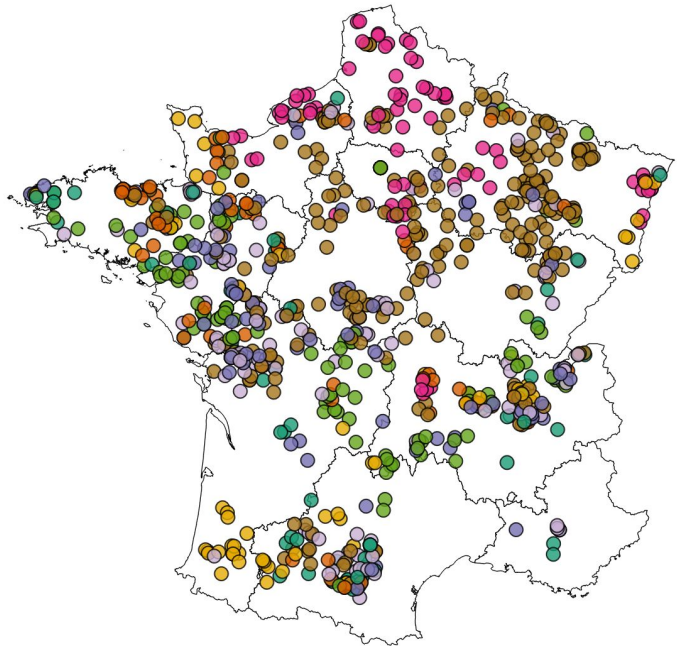
Economic feasibility of pesticide use reduction

Does implementing those alternative cropping practices influence farm economic performances?

The French **DEPHY farm** network

2000 commercial farms engaged in pesticide use reduction

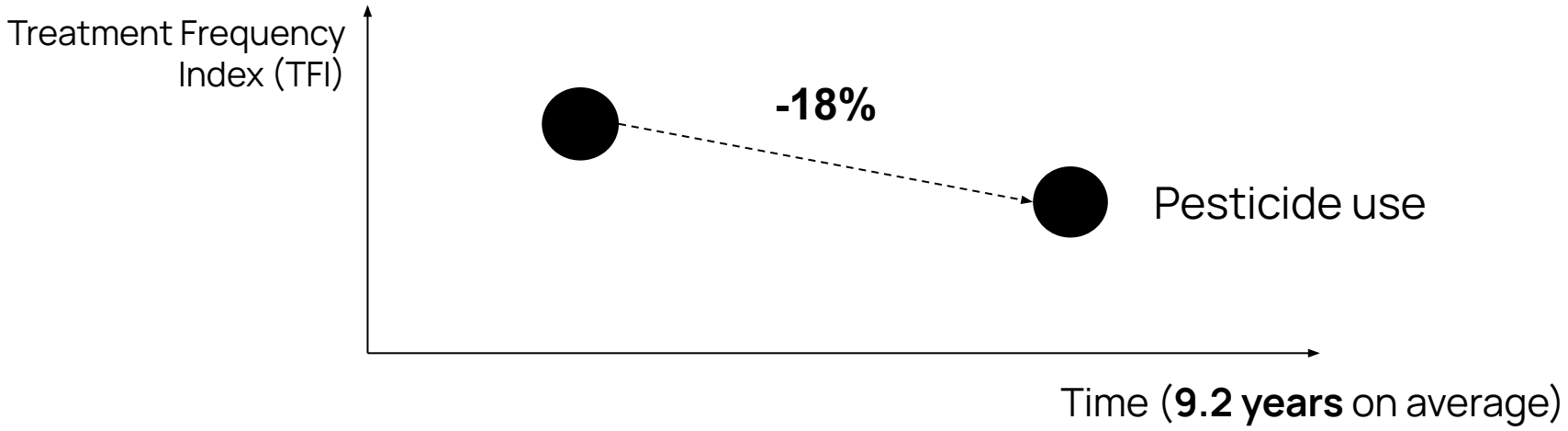
- Farmers helped by advisors
- Voluntary participation with no financial incentives

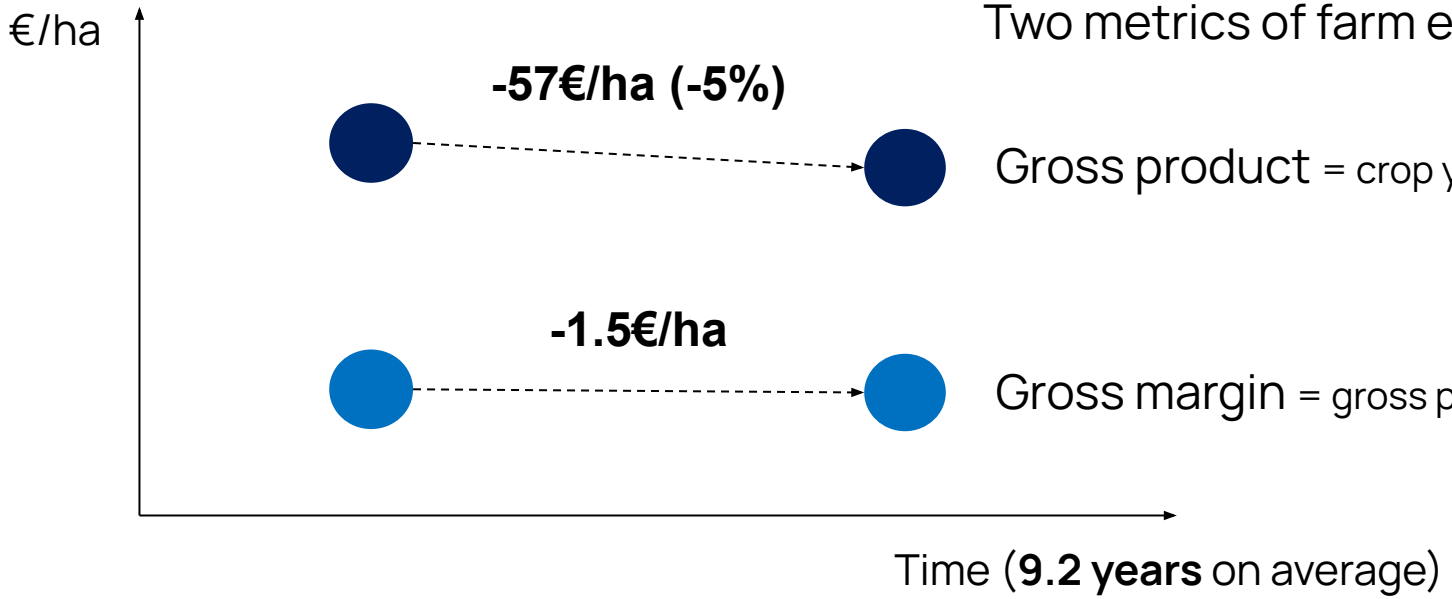


867 arable farms of 8 types:

- Cereals
- Summer crops
- Minor crops
- Industrial crops sugar beet, potato…
- Maize
- Maize-Winter wheat
- Temporary grasslands
- Others

Change in **pesticide use**, **gross product** and **gross margin** among farm types over time



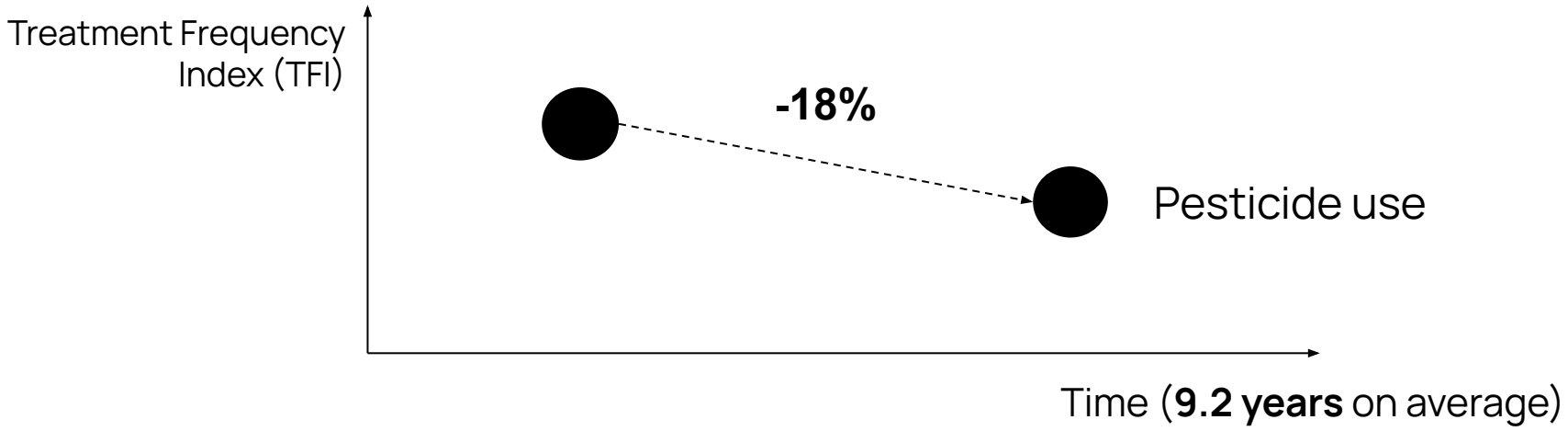


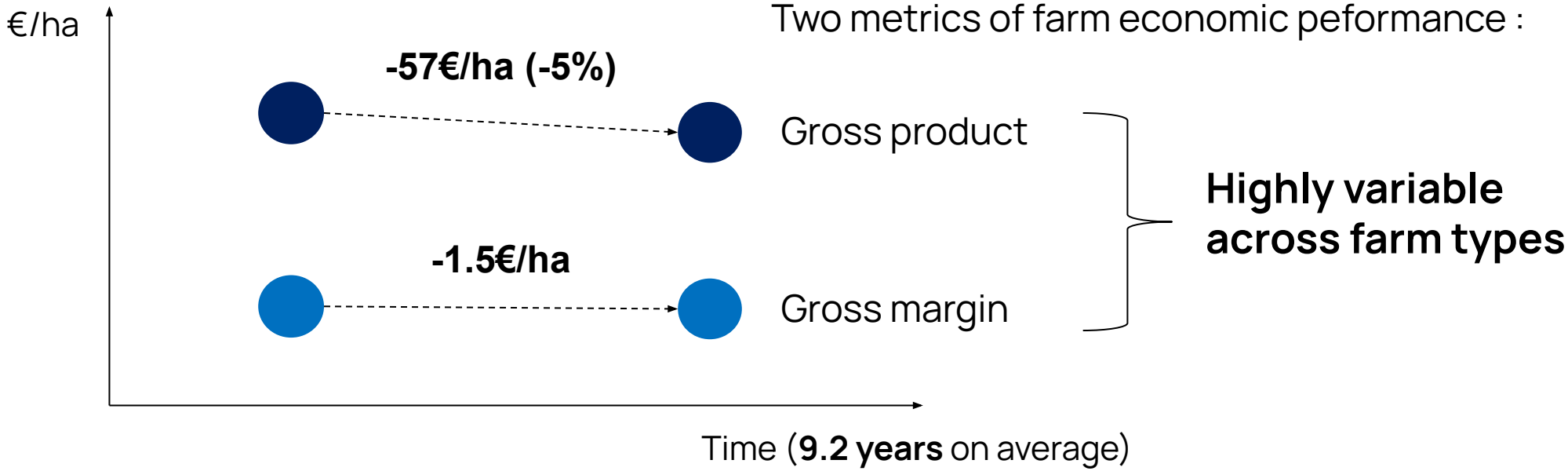
Two metrics of farm economic peformance :

Gross product = crop yields □ selling prices

Gross margin = gross product – production costs

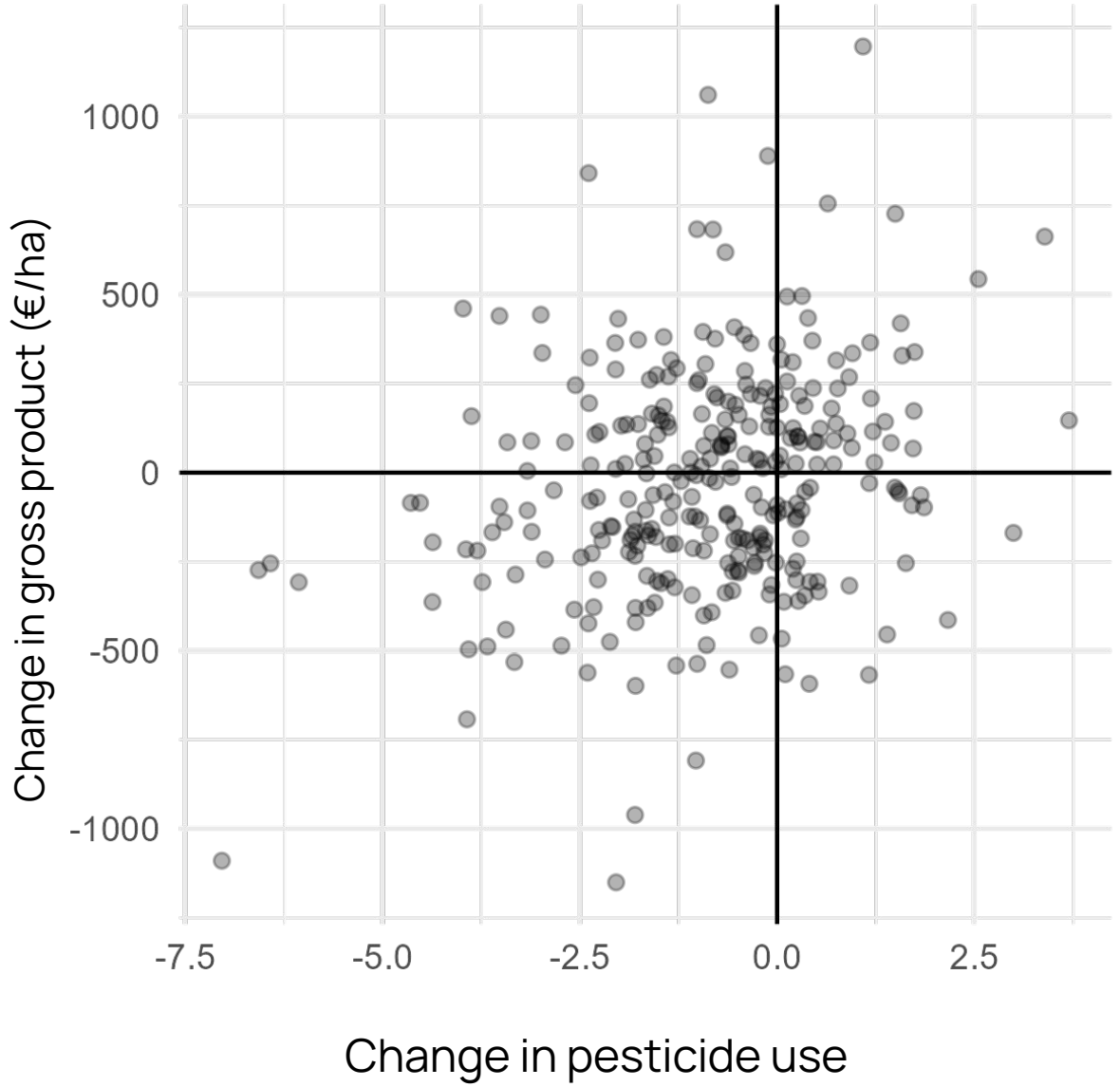
Change in **pesticide use**, **gross product** and **gross margin** among farm types over time





Link between changes in pesticide use and **gross product**

Cereal farms



Gross product = yields □ selling prices

Link between changes in pesticide use and **gross product**

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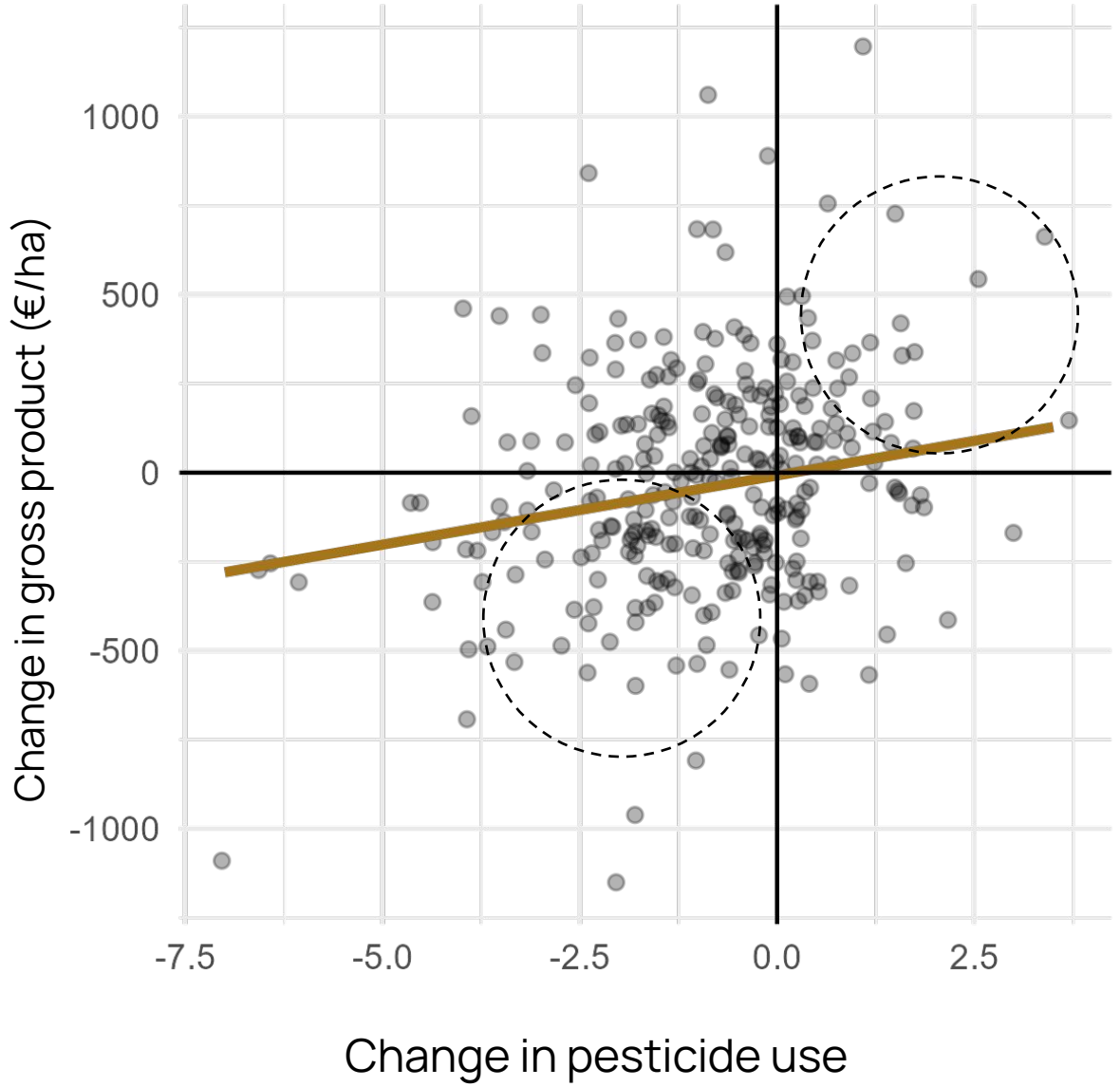
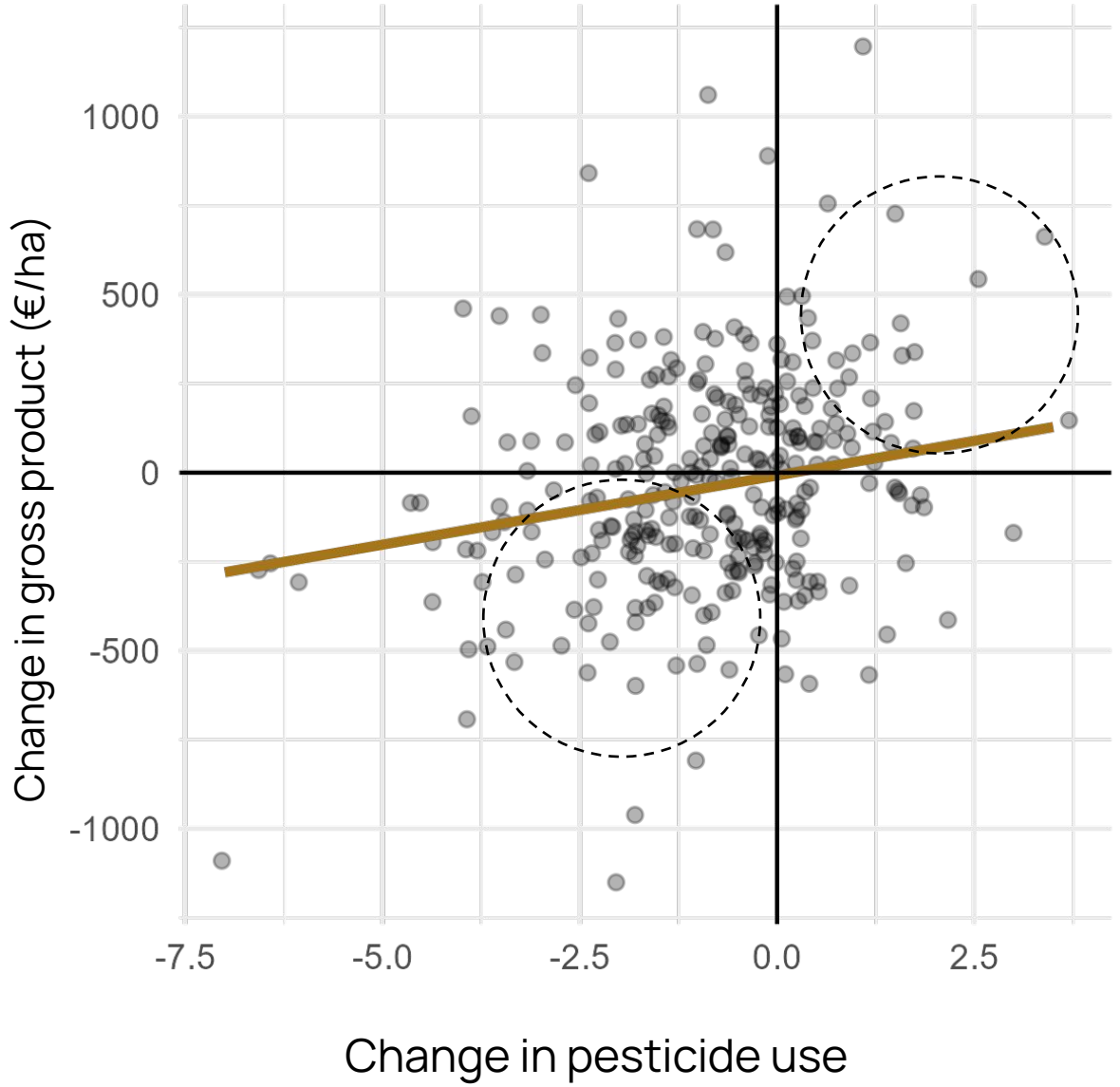


Gross product = yields □ selling prices

- Use of robust cultivars

Link between changes in pesticide use and **gross product**

Cereal farms



Gross product = yields □ selling prices

- Use of robust cultivars
- Delay of sowing dates

Link between changes in pesticide use and **gross product**

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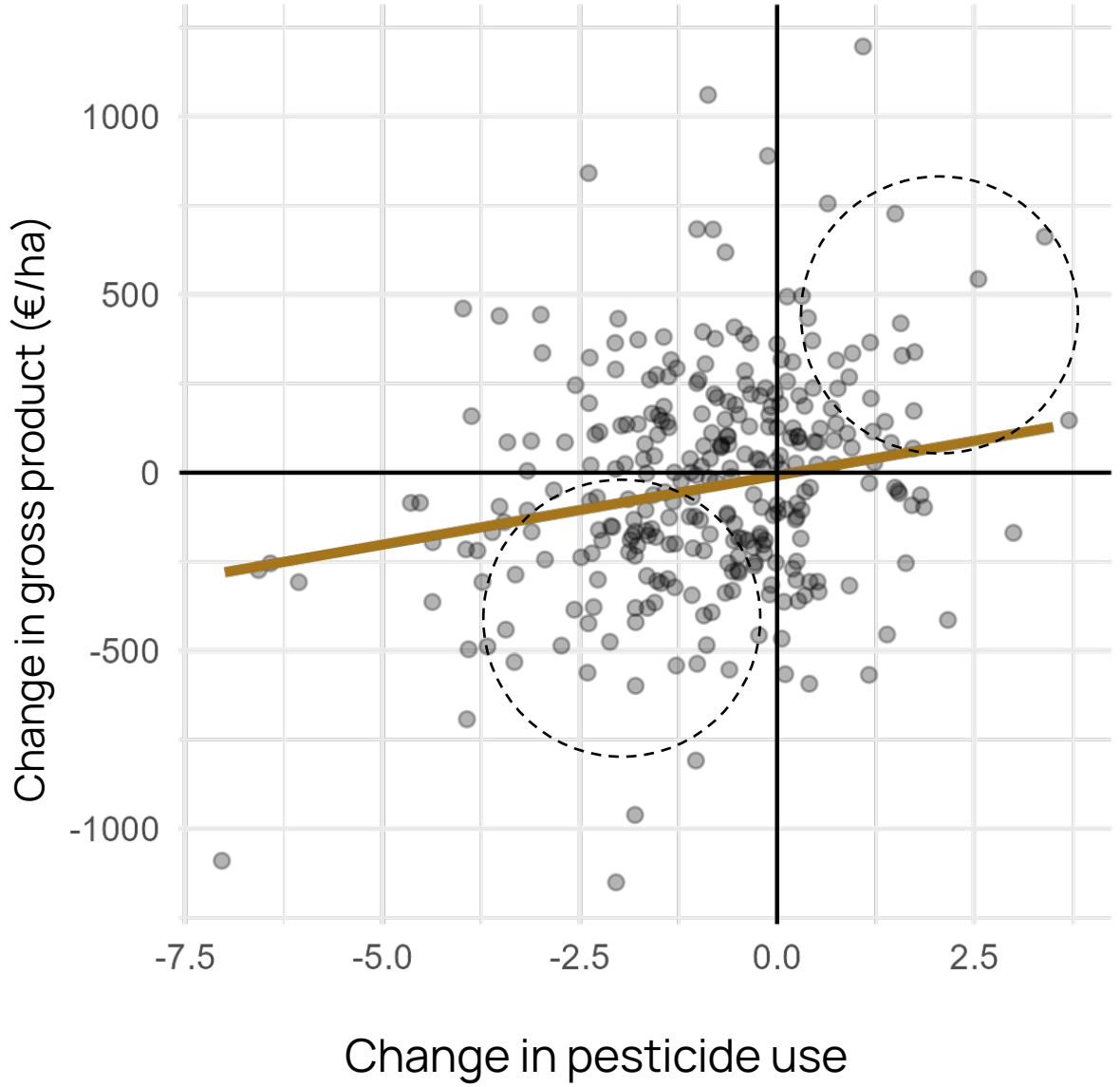
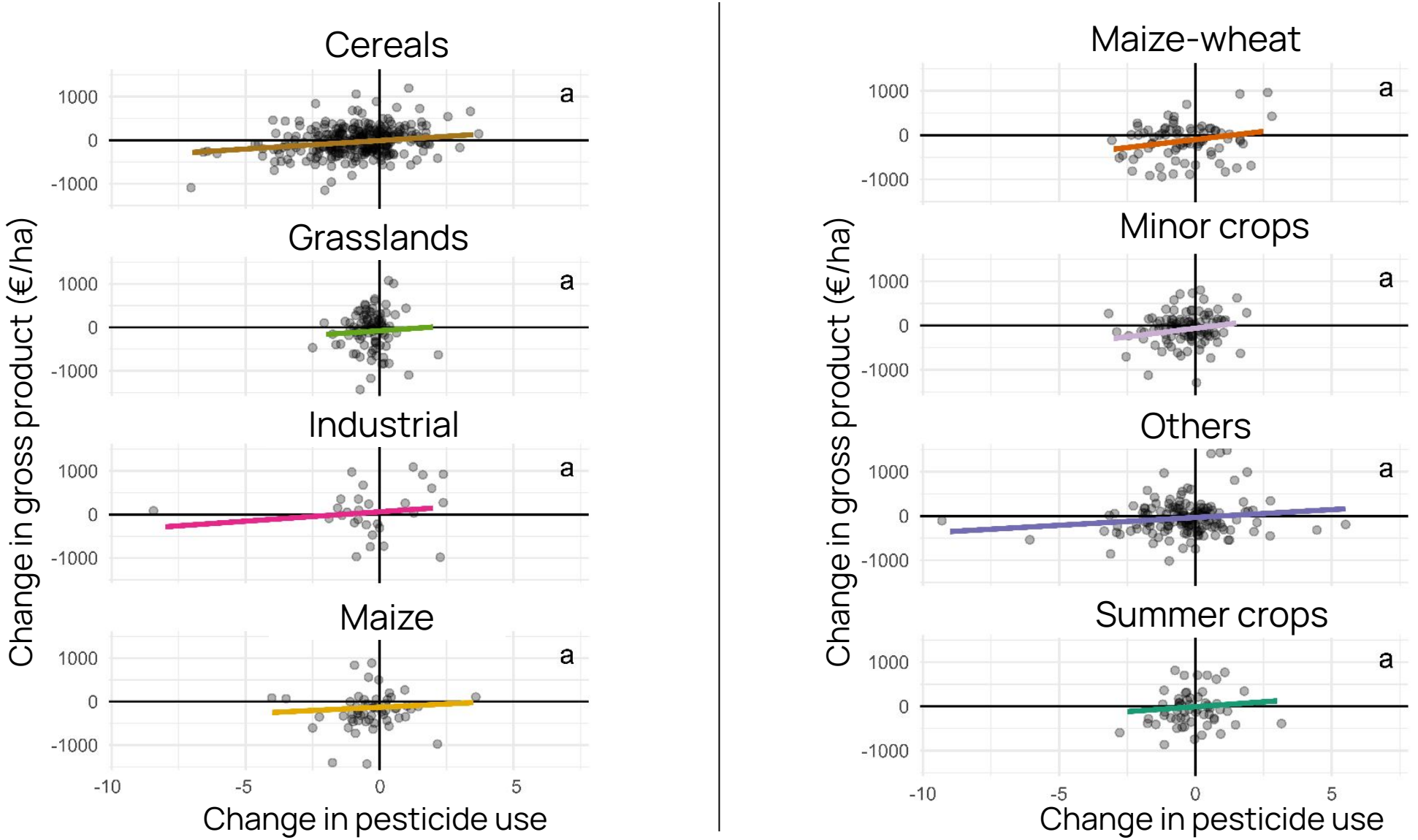


Gross product = yields □ selling prices

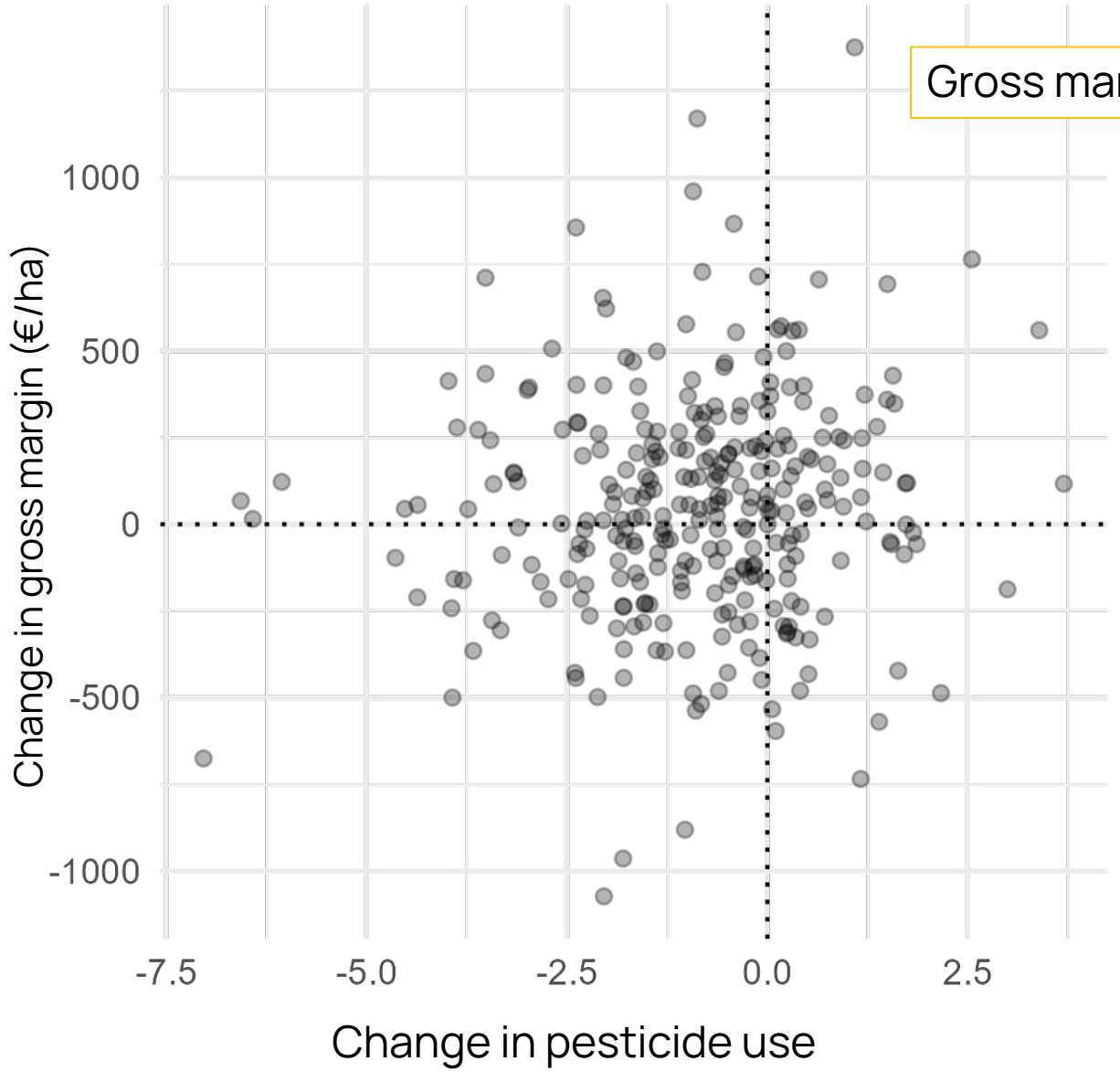
- Use of robust cultivars
- Delay of sowing dates
- Reduction of fertilization

Link between changes in pesticide use and **gross product**



Link between changes in pesticide use and **gross margin**

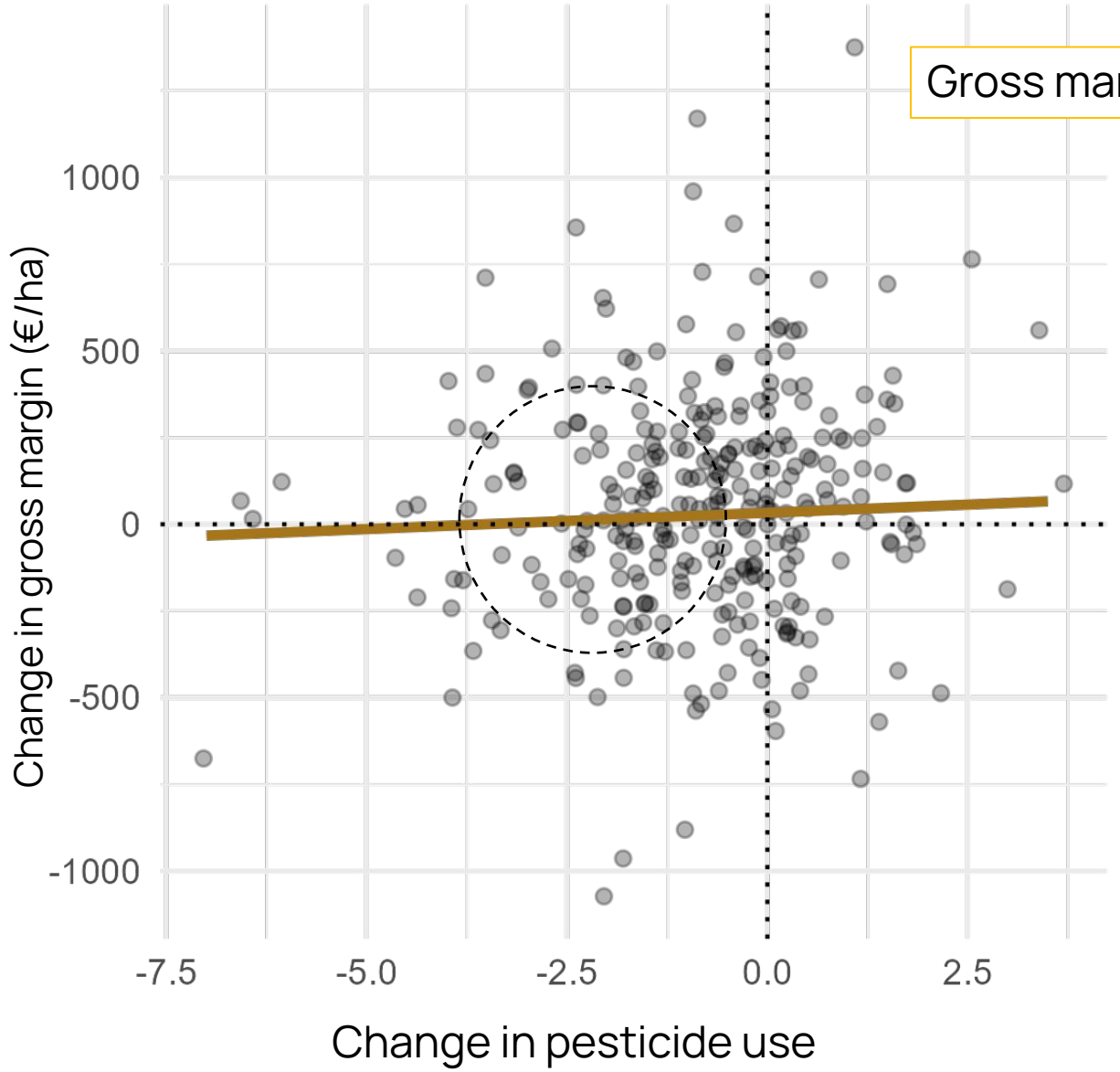
Cereal farms



Gross margin = gross product - production costs

Link between changes in pesticide use and **gross margin**

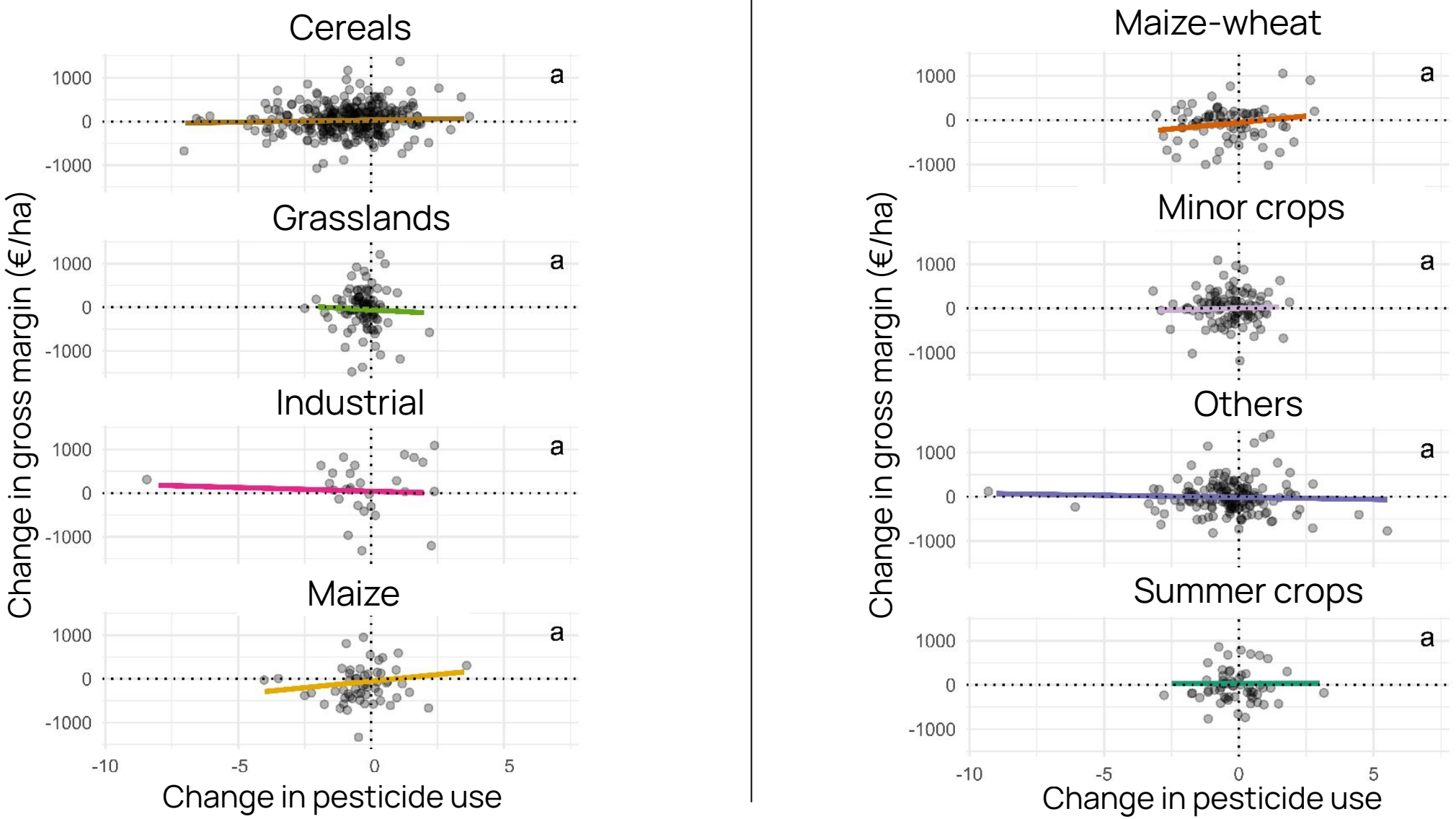
Cereal farms



Gross margin = gross product - production costs

- The **reduction in gross product** was **offset** by the **reduction in pesticide and fertilization costs**

Link between changes in pesticide use and **gross margin**



Economic feasibility of pesticide use reduction

- Practices used to reduce pesticide use can lead to **decreases in gross product**, especially in **farms growing large amounts of high value added crops**.

- On average, the **reduction in fertilization & pesticide costs offset these decreases**, allowing **farmer's income to be maintained**.

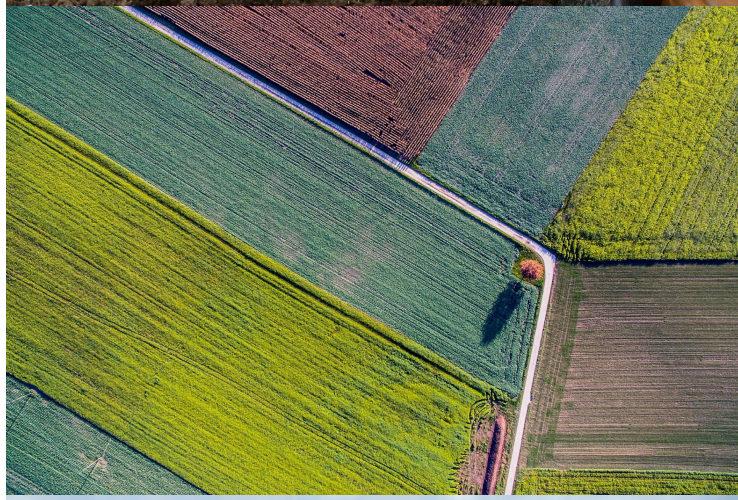
What explains the lack of progress ?

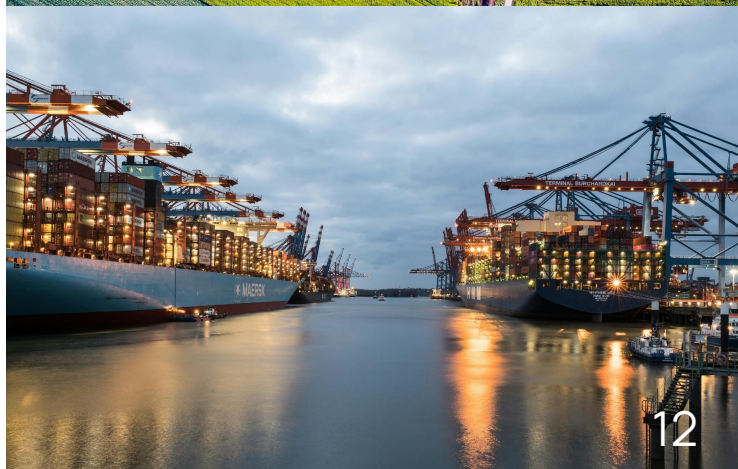
- Pesticide use reduction is possible but is not easy
- The current market is highly unfavorable
- Consumer awareness

What about food sovereignty ?

Pestiscore

Nicolas Munier-Jolain, INRAE Dijon, France





Thank you for your attention

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