

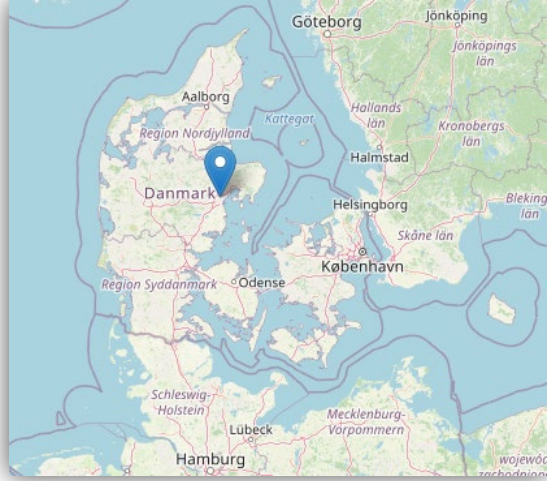
# Effects of a tax on crop protection products on agricultural practice – experiences from Denmark

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14 March 2022



# Two-layer advisory system – owned and run by farmers



Farmers

SEGES Innovation



velas

SAGRO

vkst

Fjordland

AgriNord

Etc. other  
local centres

Farmers

Farmers

Farmers

Farmers

**SEGES**  
INNOVATION





~50 per cent intensively farmed

below it all:  
groundwater = drinking water

natural areas in patches



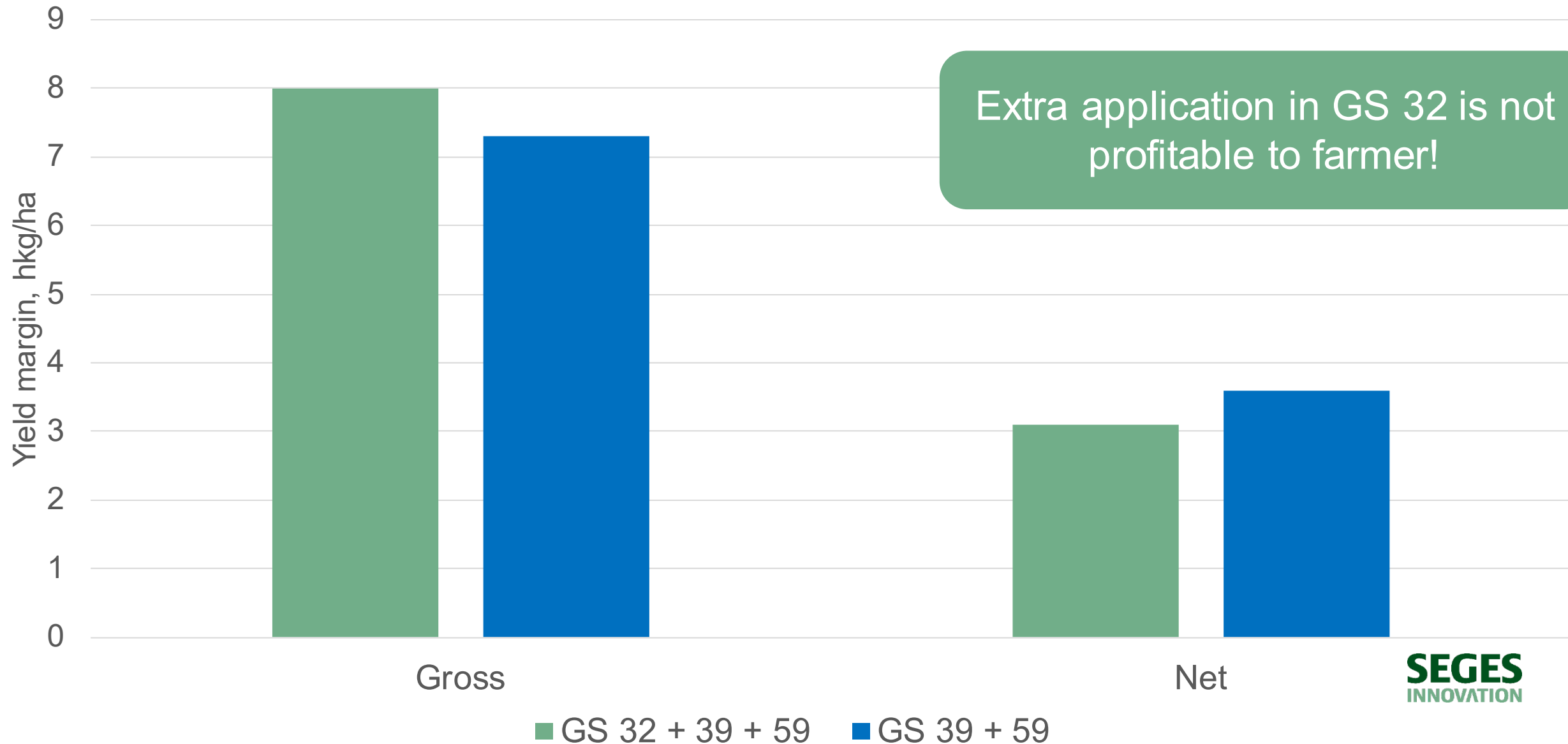
## Motto for crop protection in Denmark

As little as possible,  
but as much as necessary!

Photo: Jens Erik Jensen, SEGES Innovation

# Yield margin for applying fungicides (0,3 l Prosaro/ha) in GS 32

## 23 National Field Trials wheat 2021





# New Danish pesticide strategy 2022-2026

Five main components:

1. A record low pesticide load
2. Strict registration scheme with groundwater protection in focus
3. Increased control regime towards growers' practices
4. Research and increased use of alternatives to pesticides
5. Further adoption of good agricultural practices (Integrated Pest Management)



# History of Danish Pesticide taxes

Period	Herbicides	Fungicides	Insecticides	Growth regulators	Microbiol. products
before 1972	0 %	0 %	0 %	0 %	0 %
1972-1996	3 %*	3 %*	3 %*	3 %*	3 %*
1996-1998	15 %	15 %	37 %	15 %	3 %
1998-2013	33 %	33 %	54 %	33 %	3 %
2013-2022	New tax scheme based on pesticide load				0 %
2022-	Revised tax scheme based on pesticide load				0 %

\*) Based on wholesale price excl. VAT and other charges, considered as registration fee

From 1996 onwards, tax was based on retail price excl. VAT and other charges

## Criticism of 'ad valorem' tax model:

1. Cheap pesticides stay cheap, expensive pesticides become even more expensive
2. No credit/incentive for industry developing more environmentally benign products
3. No incentive for growers choosing less harmful products

# New tax scheme from 2013

- Two components
  - ‘Concentration of product’, i.e. active ingredient per kg/litre (C)
    - Product with 250 g ai per litre  $\rightarrow C = 0,25$
  - Pesticide load (B)
    - Very complex formula – calculator available on [www.mst.dk](http://www.mst.dk)
- Tax calculation 2013-2020
  - $6,72 \times C + 14,38 \times B$  EUR per kg/litre
- Tax calculation 2021-2022 (5,5% price index correction)
  - $7,09 \times C + 15,17 \times B$  EUR per kg/litre
- New calculation model 2023(?) and onwards
  - $2,67 \times C + 18,78 \times B$  EUR per kg/litre



# Three components in pesticide load

- Environmental effect (Danish: 'miljøeffekt')
  - Toxicity against various non-target organisms
    - Mammals, birds, bees, earthworms, fish, daphnia, algae, aquatic plants
- Environmental behaviour (Danish: 'miljøadfærd')
  - Degradation/soil half life, bioaccumulation, leachability of active ingredient + main metabolites
- Health (Danish: 'sundhed')
  - Based on labeling (H phrases) of product

## Current tax levels – examples

- Two broad spectrum pyrethroid insecticides
  - Cyperb 100 (cypermethrin 100 g/litre): 224 EUR/l
  - Lamdex (lambda-cyhalothrin 25 g/kg): 45 EUR/kg
  - Field doses comparable – Cyperb 100 totally phased out
- Two cereal herbicides
  - M-750 (MCPA 750 g/litre): 21 EUR/litre
  - Hussar Plus OD (iodosulfuron-methyl-Na 50 g/l + mesosulfuron-methyl 7,5 g/l): 9,14 EUR/litre
  - Field doses 10 times lower for Hussar Plus OD, MCPA sales strongly reduced



# Example: New Bayer insecticide Flipper®

Etikette nr.: 1  
GODKENDT  
2. marts 2022

for pakninger på  
Miljøstyrelsen  
Frederiksborg  
10L & 2x10L

5 705628 425574

**FLIPPER®**

**10 liter**

**Insekt- og midemiddel**

Må kun anvendes til bekæmpelse af melus, bladlus og mider i agurk, squash, tomat, aubergine og jordbær i åbne og lukkede væksthuse.

Dette plantebeskyttelsesmiddel må kun købes af professionelle og anvendes erhvervsmæssigt og kræver gyldig autorisation.

Insekt- og midemiddel nr. 937-1.

Omfattet af Miljøministeriets bekendtgørelse om bekæmpelsesmidler og plantebeskyttelsesmidelforordningen 1107/2009.

**Analyse**  
Fedsyre C7-C20 (umættede kallumsalte) ..... 479,8 g/l (47,8% w/w)

**Netto 10 liter**  
**Midlet er en olie i vand emulsion**

Fabr.nr.: Påtrykt emballagen.

Produktet er ved korrekt opbevaring og uåbnet emballage holdbart i mindst 2 år efter produktionsdatoen.

Produktionsdatoen påtrykt emballagen.

DK87345777A

Reg.nr. 937-1

**Indehaver:**  
Alpha BioPesticides Ltd.  
St John's Innovation Centre  
Cowley Road  
CB4 0WS Cambridge  
Storbritannien  
Tel. +44 (0) 1223 911766

**Distributør:**  
Bayer A/S  
Arne Jacobsens Allé 13  
DK-2300 København  
Danmark  
Tel. 08 580 223 00

**Bayer**

Middeldatabasen

4. marts 2022 **SEGES**  
INNOVATION

Produktoplysninger

**Flipper**  
Skadedyrsmiddel

Almene oplysninger Godkendelse Anvendelse E

**Bemærk**

Oplysningerne nedenfor er baseret på informationer indhentet mv. Trods udvist omhu under dataindsamling og -indtæring oplysningernes korrekthed. Eventuelle fejl og tilføjelser bedes indrapporteret til konsulent jnj@seges.dk.

Læs altid etiketten

**Pesticidbelastning:**

Indikator	1 B	B pr. enhed
Sundhed = Health	5,75 l/ha	0,174 B/l
Miljøadfærd = Env.beh.	68,2 l/ha	0,0147 B/l
Miljøeffekt = Env.effect	14,7 l/ha	0,0679 B/l
I alt Total	3,90 l/ha	0,257 B/l

**Pesticidafgift: 55 kr. pr. l = Pesticide tax**

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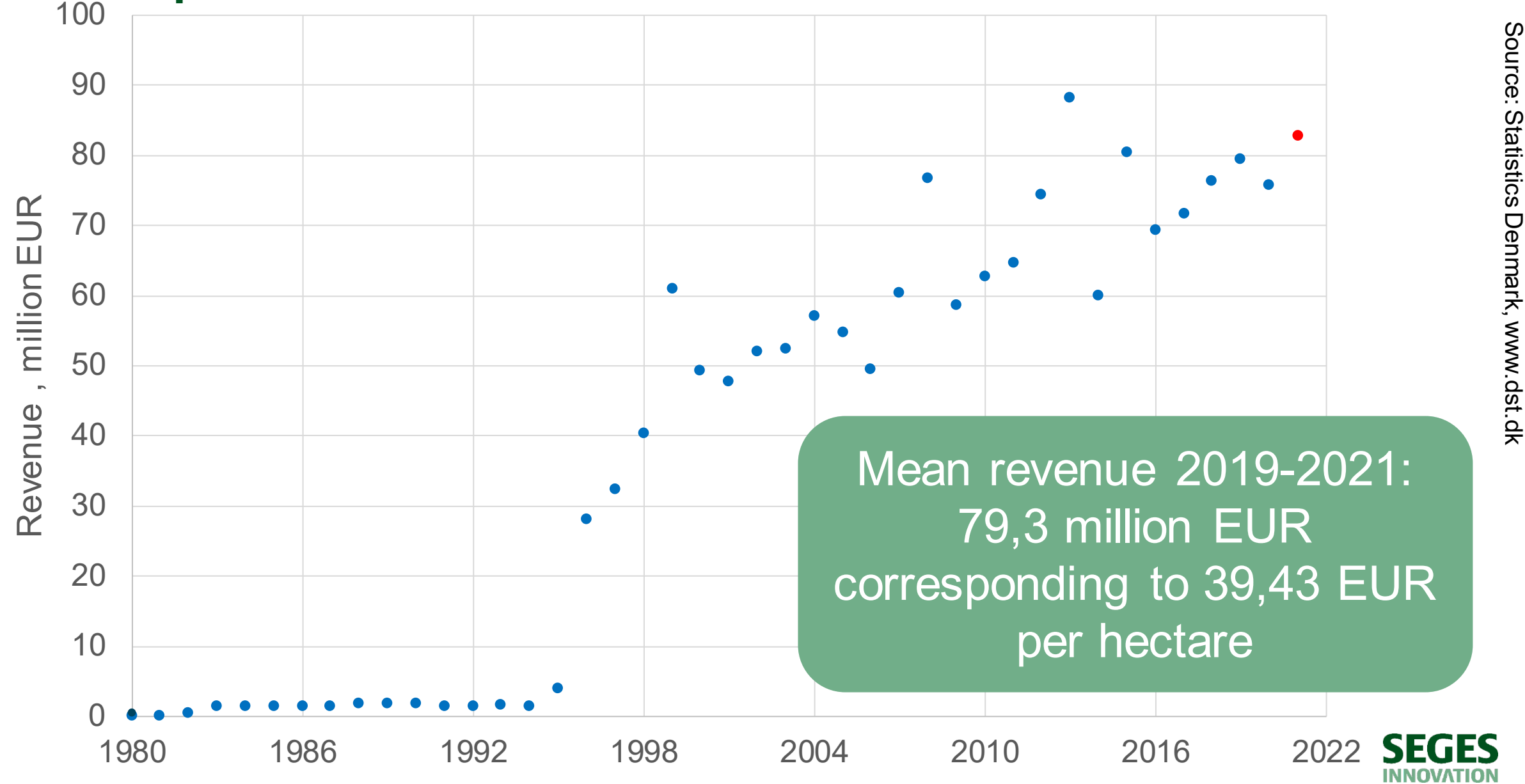
**Almene oplysninger**

<b>Tidligere navn(e)</b> Ingen	<b>Pris (senest opdateret)</b> Ingen oplysninger
<b>Pakningsstørrelse</b> 10 l	<b>Formulering</b> Olie i vand emulsion
<b>Registreringsindehaver</b> Alpha BioPesticides Ltd.	<b>Status</b> Markedsført
<b>Distributør</b> Bayer CropScience	<b>Indhold af aktivstoffer</b> 479,9 g/l fedsyrer (C7-C18 og C18 umættede
<b>Anvendes indenfor</b> Væksthusgartneri	

Flipper label dose: 16 litres per hectare means a tax of  $16 * 55 \text{ DKK} = 118 \text{ EUR}$  per hectare per application (max. 5 applications per year)!

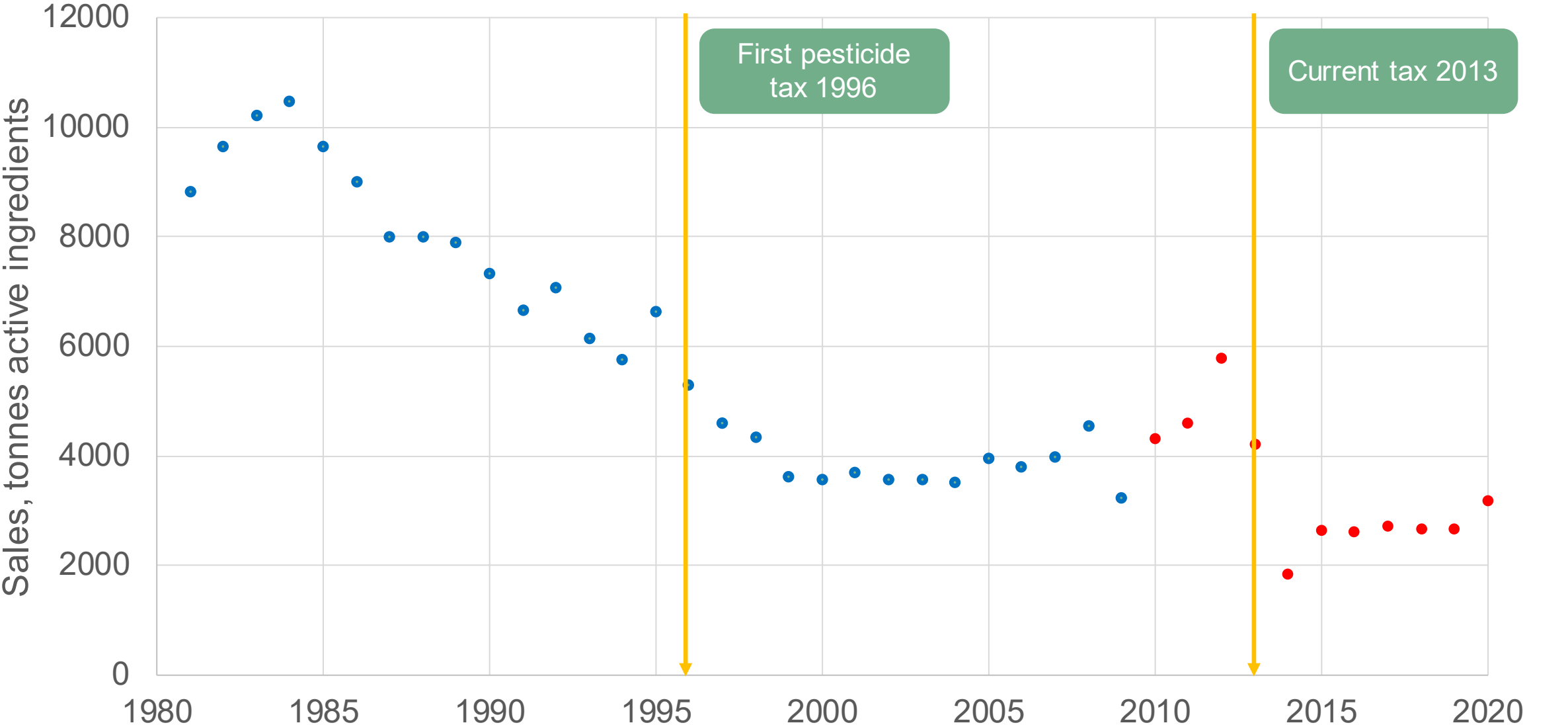
New tax model makes it 98 EUR per hectare per application

# Danish pesticide tax revenue 1980-2020



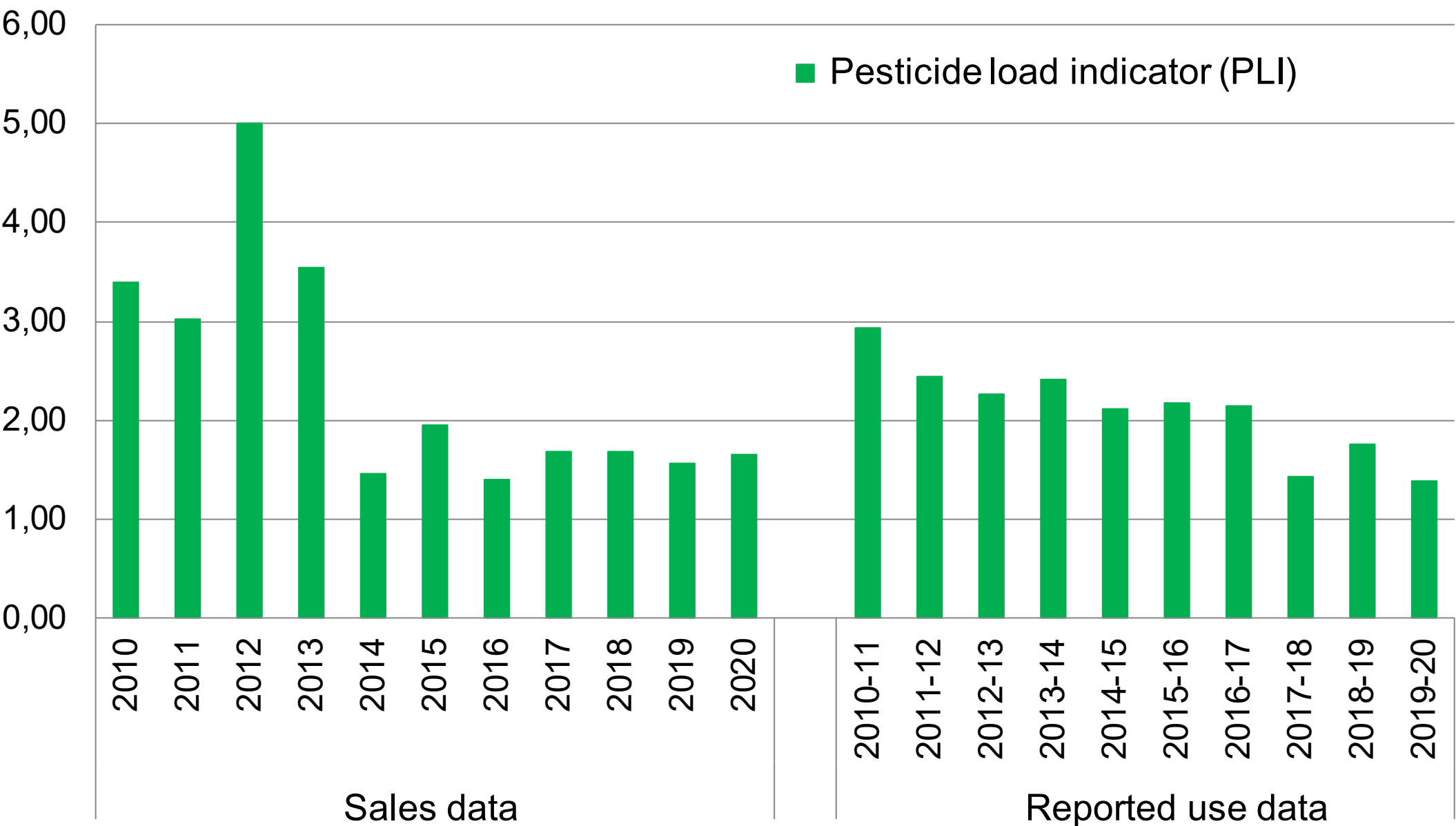


# Danish pesticide sales 1980-2020



Source: Annual pesticide statistics from Danish EPA (In Danish: 'Bekæmpelsesmiddelstatistik')

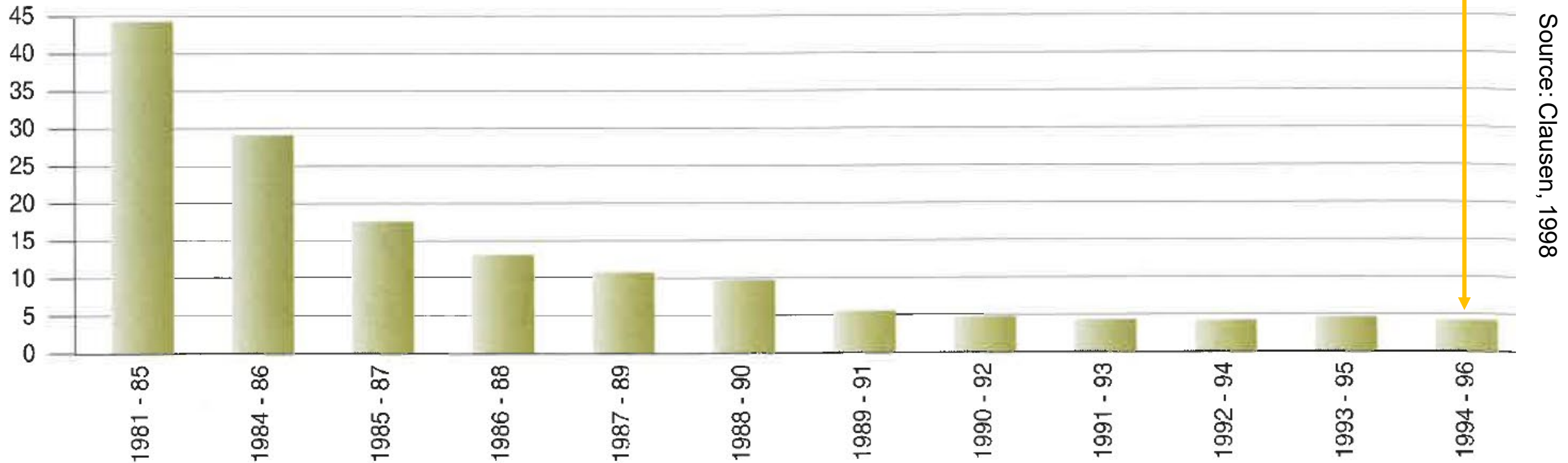
# Danish Pesticide Load Indicator (PLI) 2010-2020



Source: Annual pesticide statistics 2020 from Danish EPA



# Danish Pesticide load for mammals 1981-1996



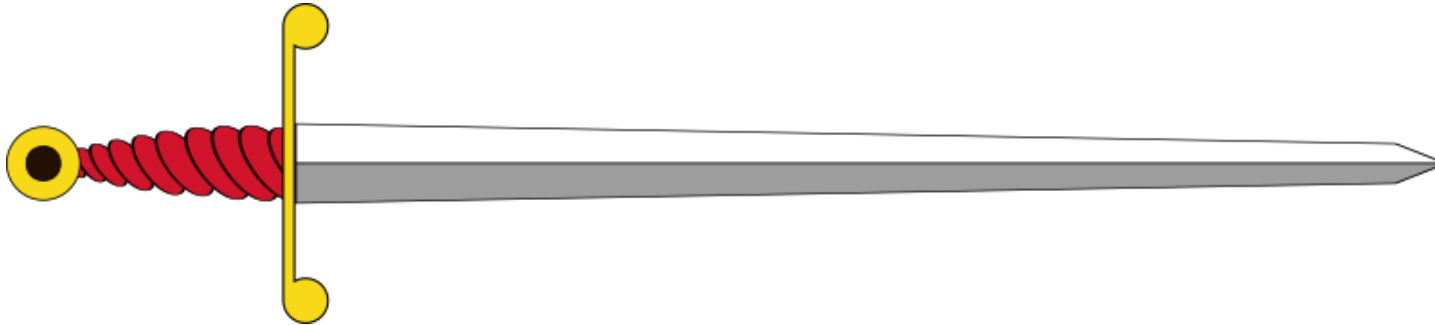
The reduction in pesticide load started long before taxes were implemented!

# Advisory perspectives regarding Danish pesticide tax

- Has meant early phase out of some active ingredients
  - mancozeb
  - ioxynil/bromoxynil
- Strongly reduced use of certain active ingredients
  - cypermethrin, alpha-cypermethrin
  - pendimethalin
  - MCPA
- Advice to keep using some expensive products to prevent resistance, e.g.
  - Boxer (prosulfocarb)
  - Mateno Duo (aclonifen+diflufenican)

# Advisory perspectives regarding Danish pesticide tax

- Handicapping competitiveness of Danish farmers
- Only part of revenue used for funding agricultural innovation
- Two-edged sword:
  - Incentive for growers to reduce (theoretical) environmental and health load



- More limited number of active ingredients in use
- Development of resistance may accelerate!



# Grower practice and environmental load on a windy day

Standard flat fan nozzle



Wind direction 

Compact air induction nozzle



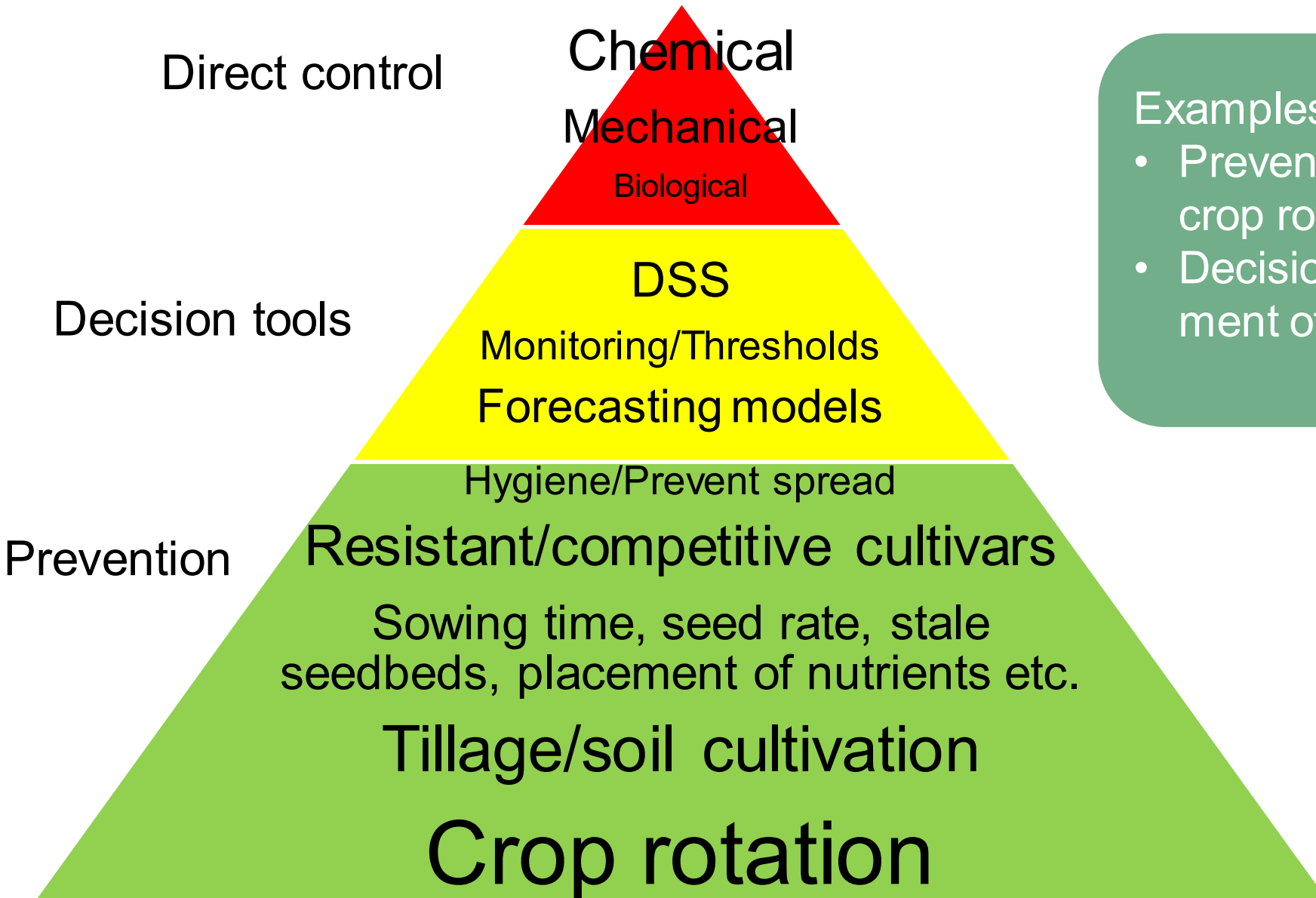


## Closed transfer systems – can reduce operator exposure



Images courtesy Bayer

# There are many other ways to reduce pesticide load

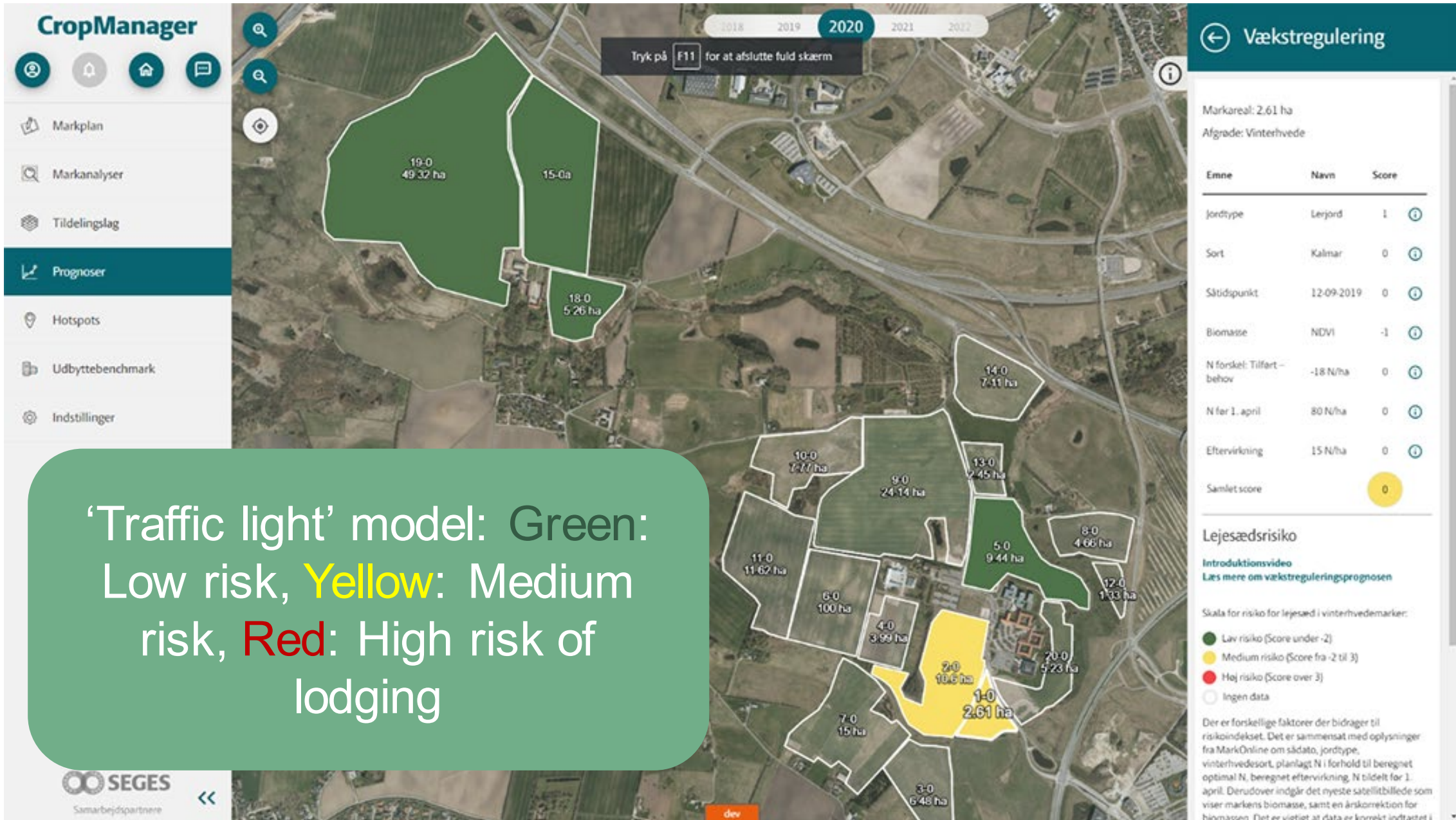


## Examples:

- Preventive measures, e.g. healthier crop rotations
- Decision support: Careful assessment of need for intervention



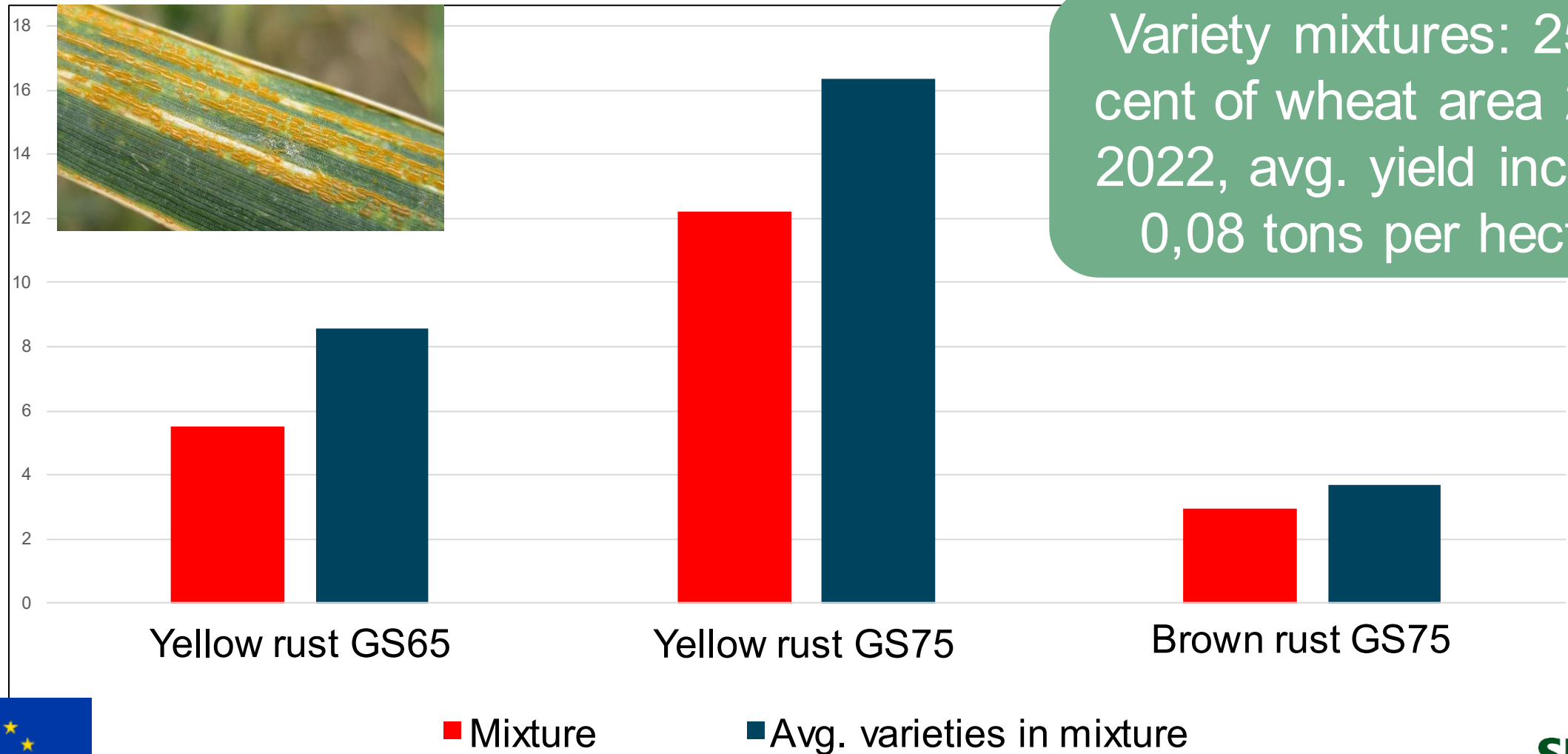
# Lodging risk prognosis



‘Traffic light’ model: Green: Low risk, Yellow: Medium risk, Red: High risk of lodging

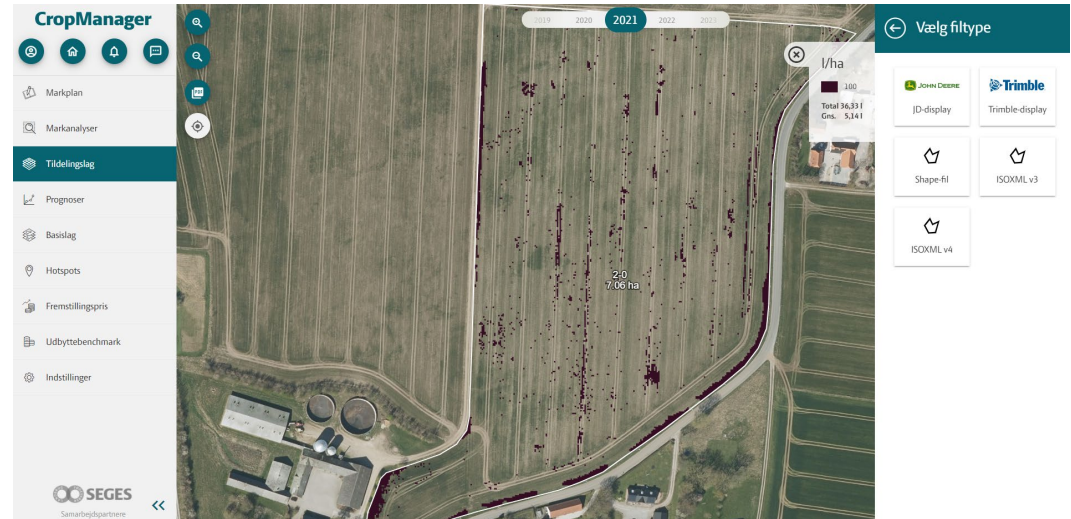
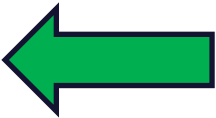
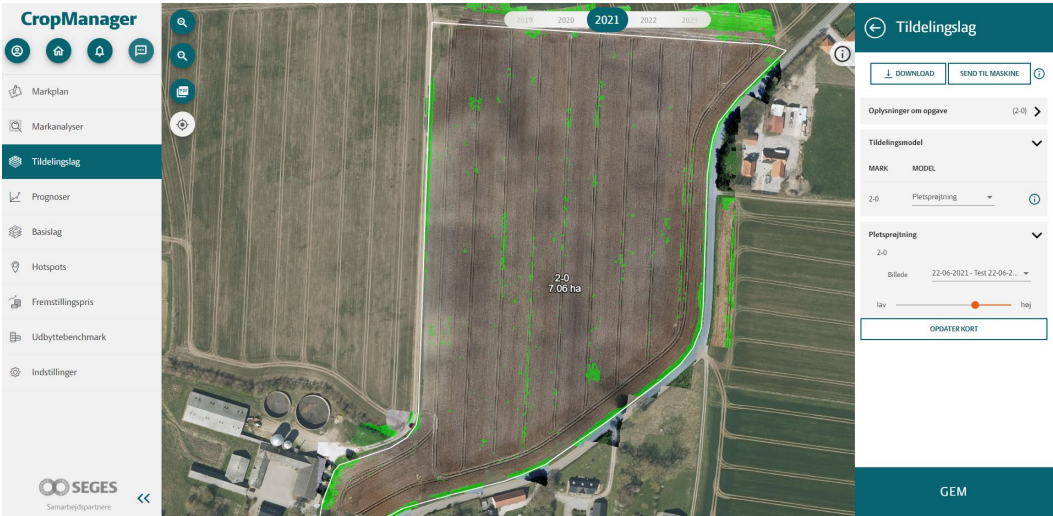
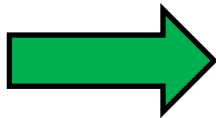
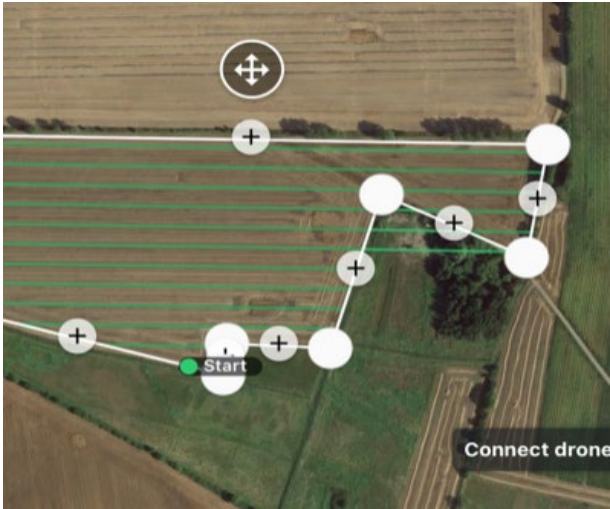
# Effect of variety mixtures on yellow rust and brown rust in wheat

## Data from RustWatch EU project, Aarhus University





# Precision farming – Danish Thistle Tool for weed mapping





# Mechanical weed management in maize



Photo: Thyregod



# Protect and preserve existing small biotopes in landscape



Photos: Anne Erland Eskildsen, SEGES Innovation