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Clubroot, a permanent threat to Swedish oilseed production

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International Clubroot Workshop, Edmonton, Canada, 2013

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Brassica cultivation in Sweden

Cultivation of various Brassica crops has a long history in Sweden



May turnip *Brassica rapa* ssp *rapa*



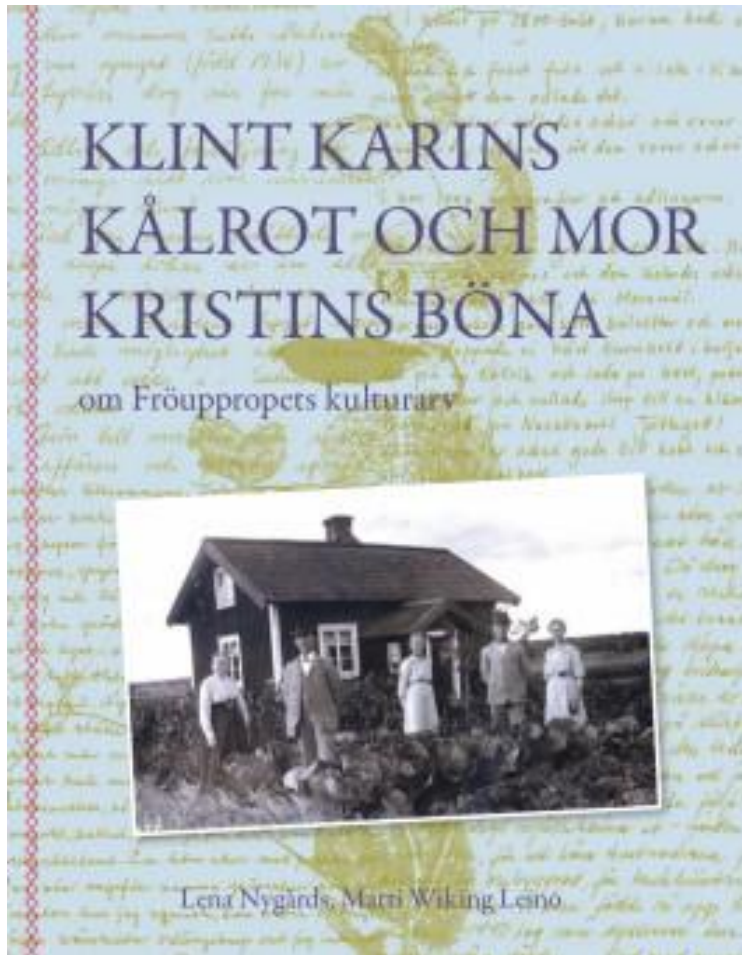
Gränsrova
"Boarder turnip"



Måselvnepe,
Lofoten Norway



Brassica rapa ssp *napobrassica* L



SWE Kålrot, "rotabagge"

UK Swede, US rutabaga




Monitoring and control of *Plasmodiophora brassicae* in Spring Oilseed Brassica Crops

Background

- Oilseed rape and oilseed turnip rape became popular field crops during the 1940's.
- By 1970 an oilseed crop was encouraged every fourth year



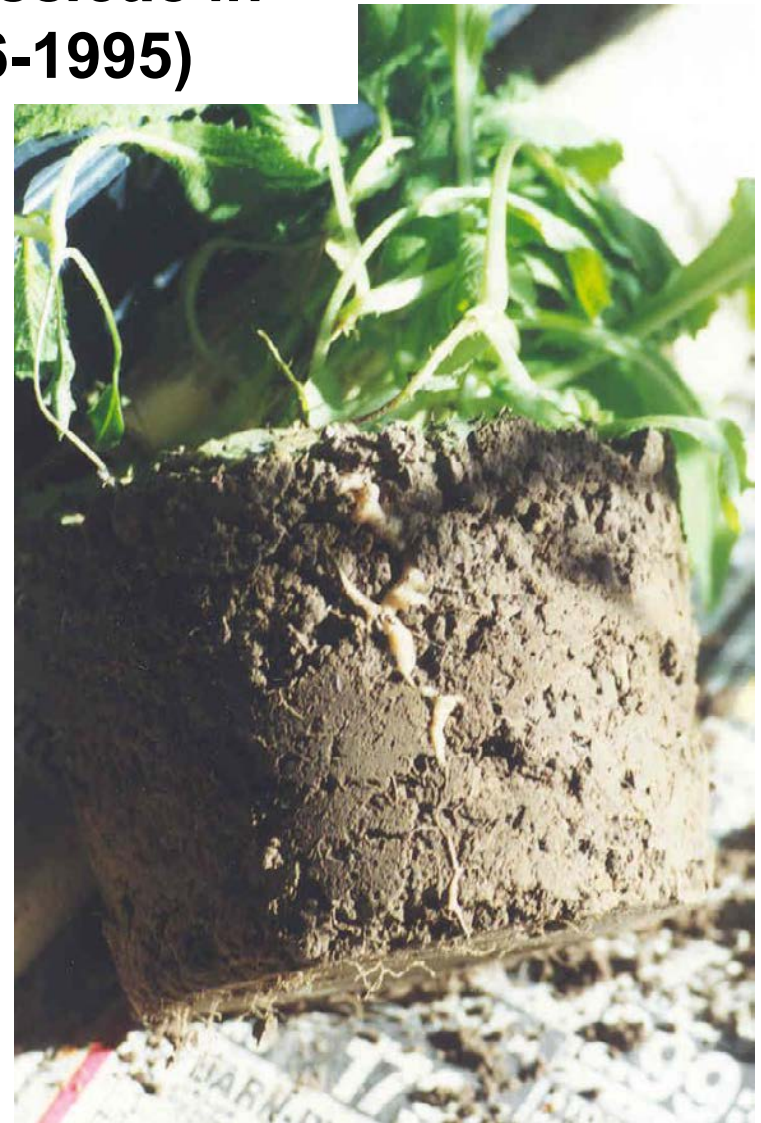


**Clubroot became an important
disease in Swedish Brassica crops**

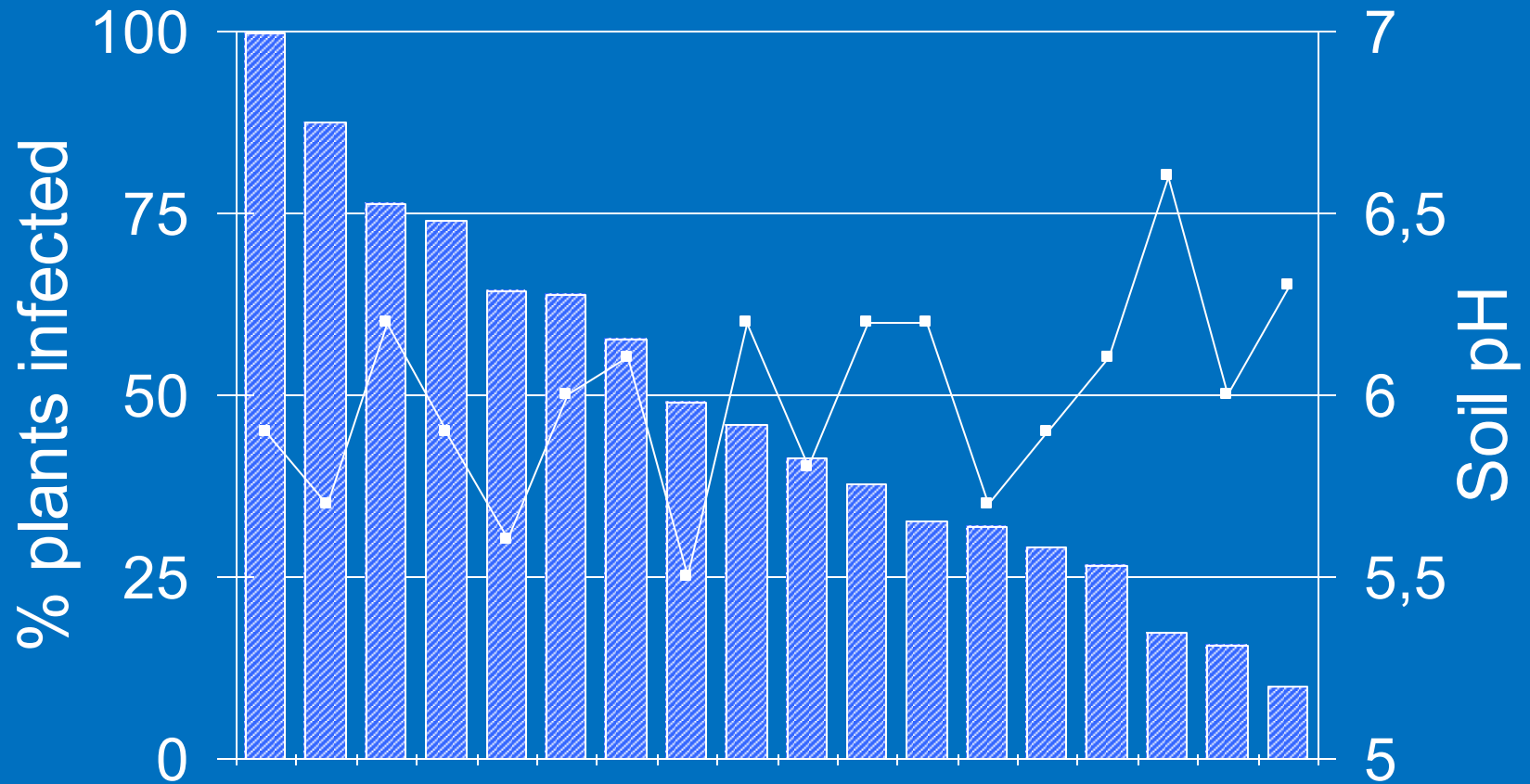
**In the early 1980's severe attacks
were observed**

Bioassay and control of *P. brassicae* in spring oilseed brassicas (1986-1995)

- The occurrence and longevity of *P. brassicae* was investigated in a county in central Sweden
- The infection level of *P. brassicae* in field soil samples was determined by a greenhouse bioassay

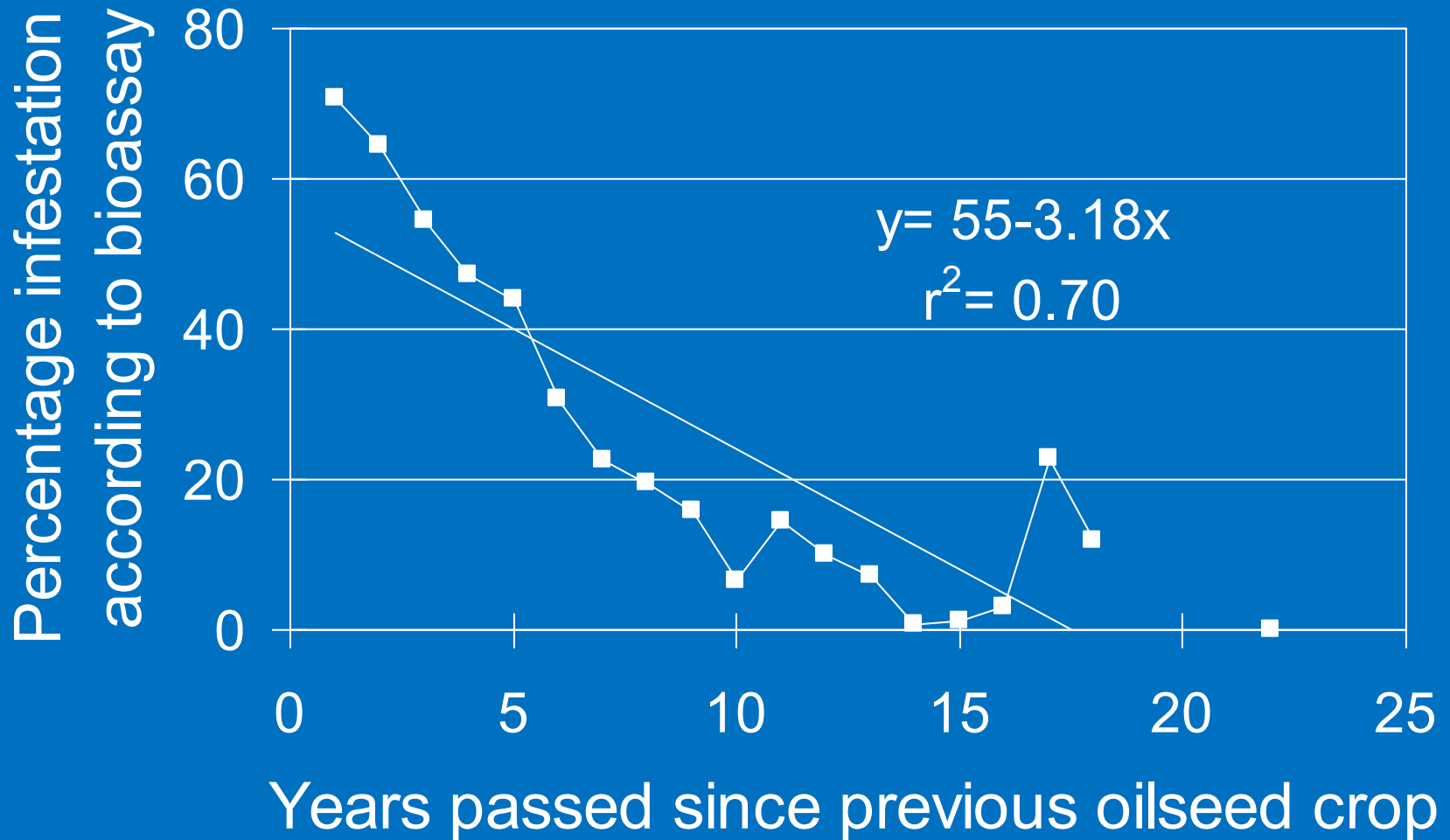


Average infestation and average soil pH for each farm

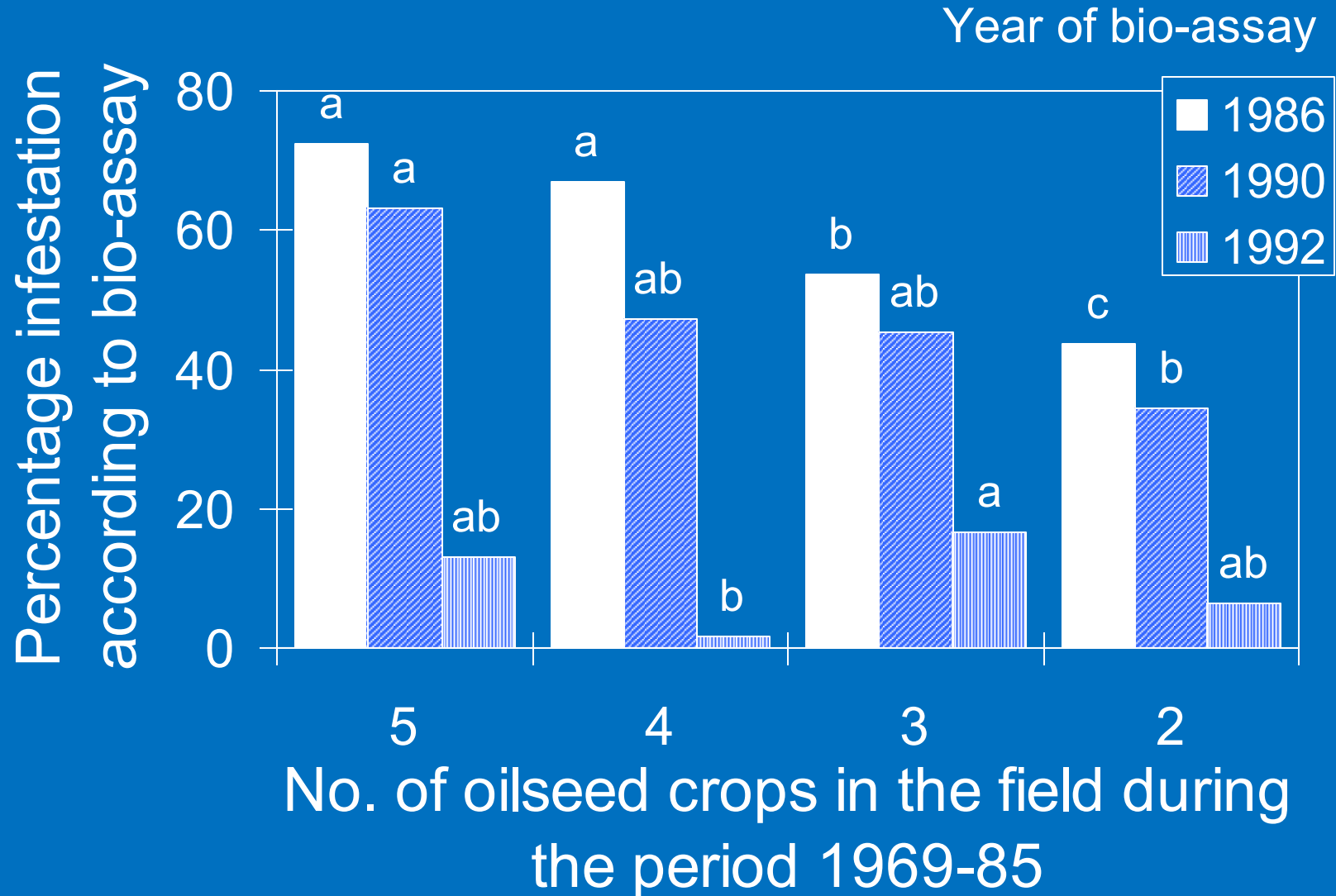


Wallenhammar, 1996

Correlation with previous oilseed crop



Correlation with cropping frequency

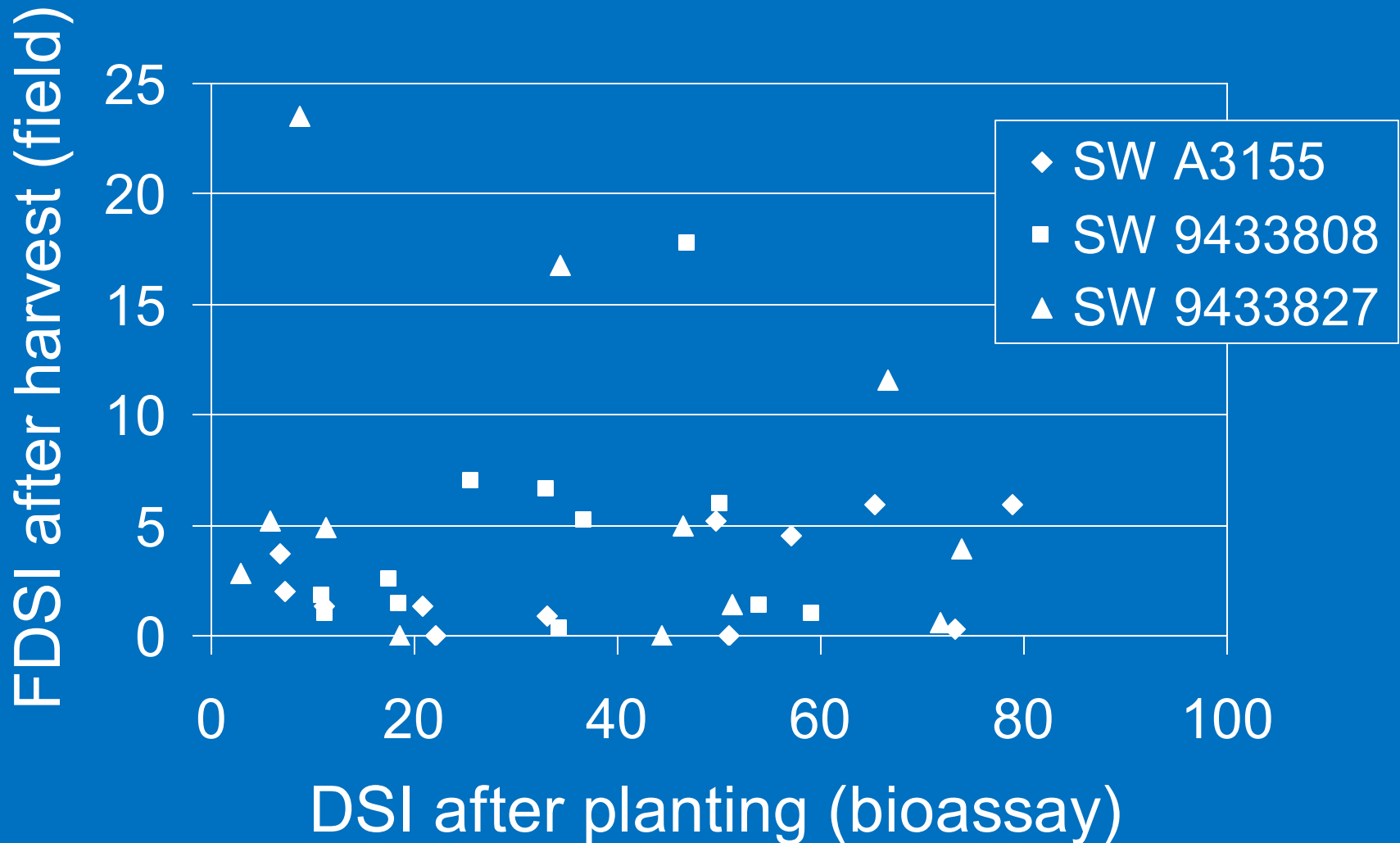


New techniques for integrated control of clubroot (1997-1999)

- Agronomic performance of partly resistant lines of spring oilseed turnip rape
- What inoculum level in the soil is tolerated?



Disease severity indices for partly resistant lines (4 field exp. 1997)



Strategy for integrating partly resistant cultivars in the crop rotation:

- **Low infection level**

DSI < 10

Cultivation is possible avoiding yield loss

- **Moderate infection level**

DSI (10- 40)

Cultivation is possible avoiding severe yield loss

- **High infection level**

DSI > 40

Cultivation is not recommended due to great multiplication of inoculum

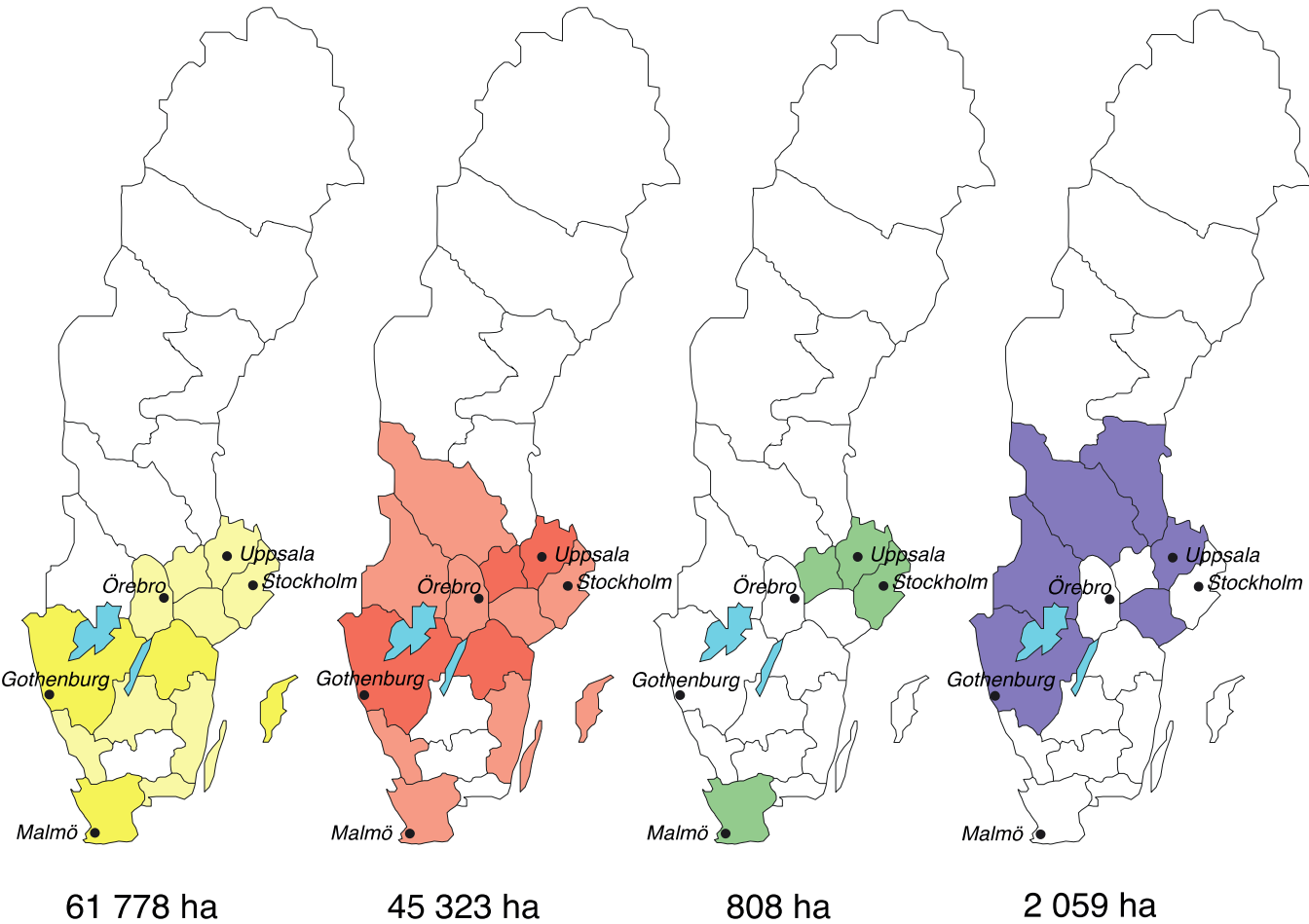
A close-up, low-angle shot of a vast field of yellow oilseed rape flowers. The flowers are in full bloom, with bright yellow petals and dark centers. The green stems and leaves are visible, creating a dense, textured background. The lighting is bright, suggesting a sunny day.

Oilseed production in Sweden today

130 000 hectares 2013

110 000 hectares 2012

Distribution of Brassica oil crop acreages in Swedish counties 2012



- B. napus* winter type
- B. napus* spring type
- B. rapa* winter type
- B. rapa* spring type

Counties with > 4000 ha indicated by darker colour codes

Clubroot attacks in Winter Oilseed Rape



Veneberg, 2006

Reports from advisors in south Sweden april 2013



Photo: Gunnel Hansson

Determination of *Plasmodiophora brassicae* in farm fields



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DNA-based detection of *P. brassicae* in soils

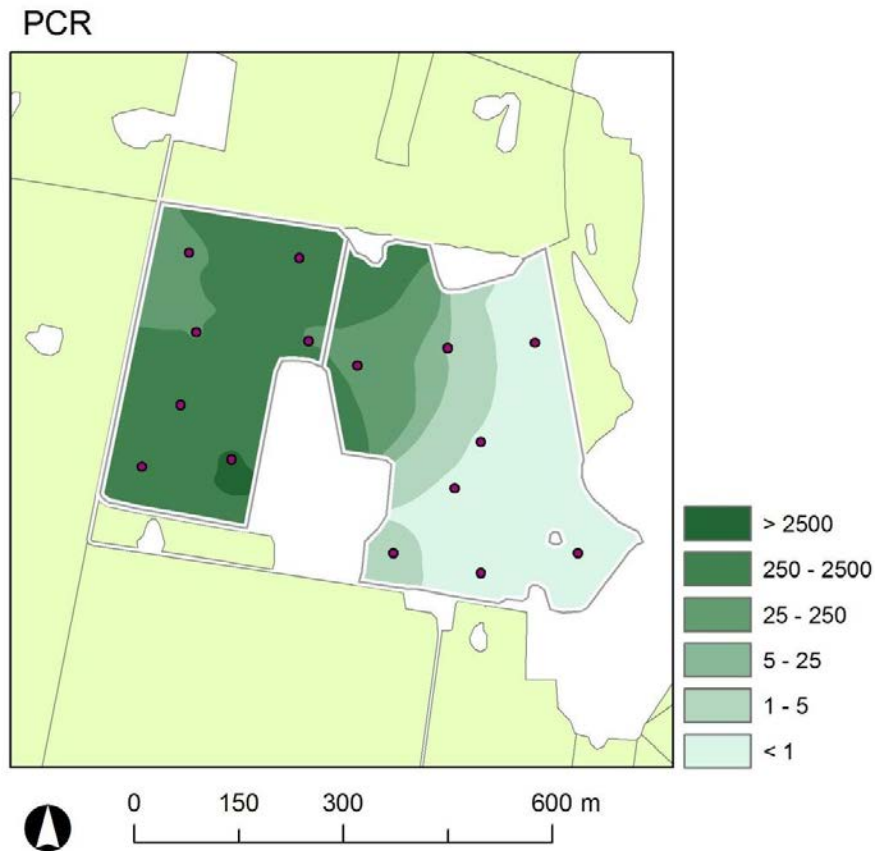


- A real-time PCR method to detect and quantify *P.brassicae* in soil samples was developed.
- Detection limit of 500 g spores g⁻¹ soil
- The soil test is now provided by an accredited laboratory

Wallenhammar et al., 2012



Spatial distribution of *P. brassicae* at Veneberg 2006

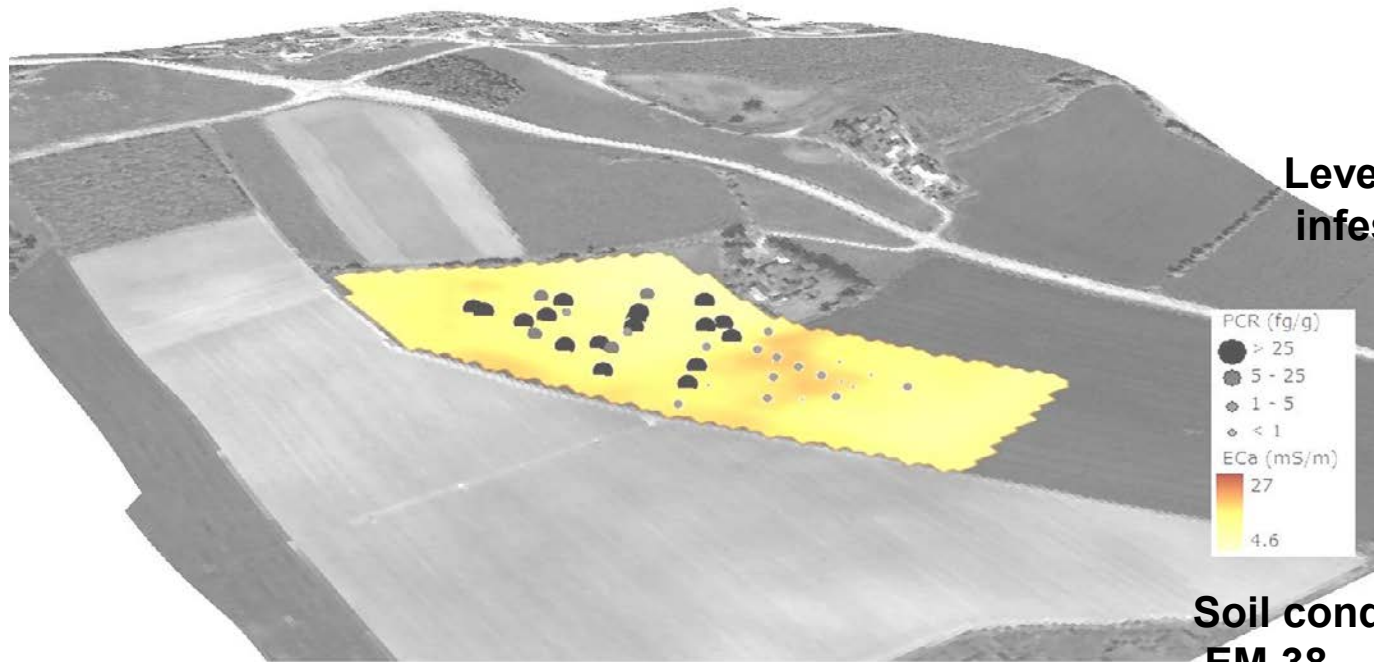


PCR (fg plasmid- DNA g⁻¹ soil)

Biological Soil Mapping of Pathogens

Multidisciplinary Thematic Research Program 2009-2015

The Faculty of Natural Resources and Agricultural Sciences, SLU and eleven stakeholders

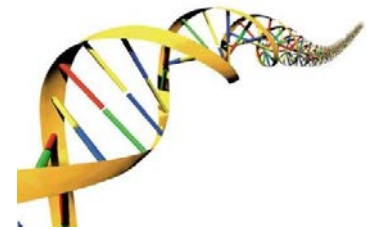


The BioSoM program aims to

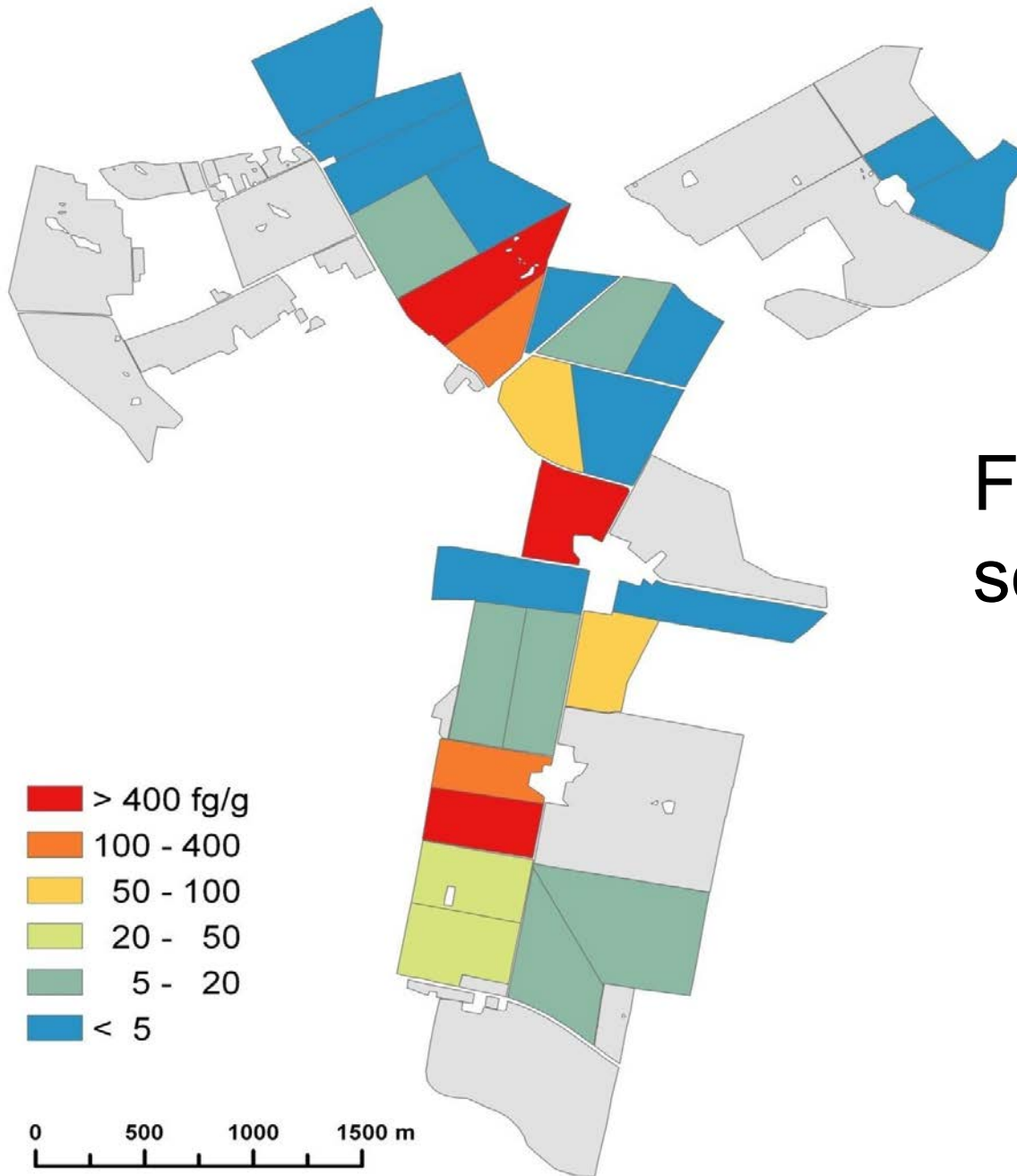
- Provide scientific support to new services for farmers enabling detection and mapping of soil-borne plant pathogens
- Communicating research is important. Introduction of a new way to implement results and decision-making

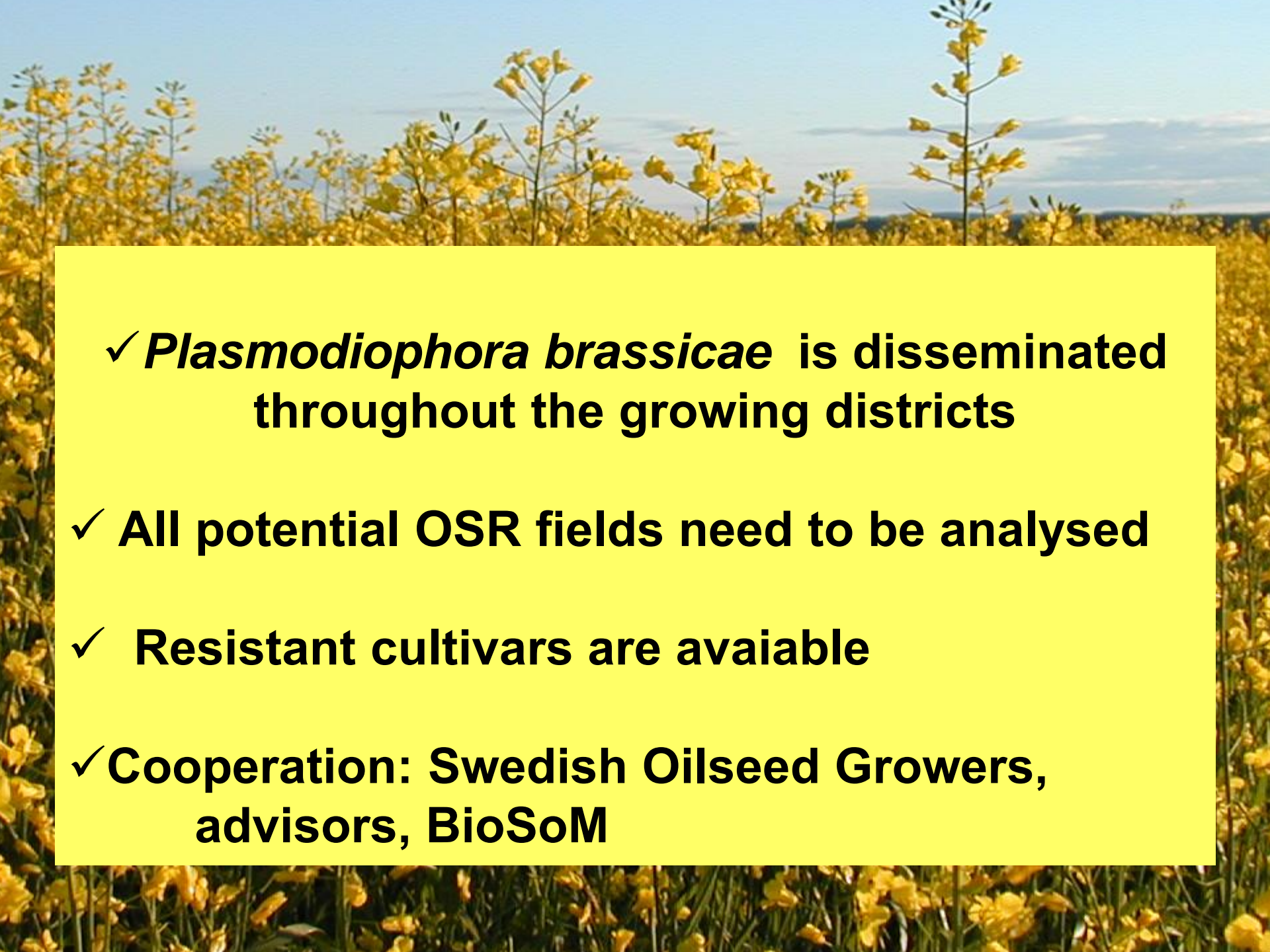
***P. Brassicae* has a central role**

- Soil sampling procedures on field level, storage of samples, homogenizing methods
- The influence of nutrients on the susceptibility of *P.b*
- The race status need a switch to molecular tools to clarify the situation
- A first glance at the genome of a *P.brassicae* single spore isolate has been generated (Schwelm et al., 2012)



Farm fields soil test



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- ✓ ***Plasmodiophora brassicae* is disseminated throughout the growing districts**
 - ✓ **All potential OSR fields need to be analysed**
 - ✓ **Resistant cultivars are available**
 - ✓ **Cooperation: Swedish Oilseed Growers, advisors, BioSoM**



Acknowledgement the funding for the BioSom program



Lantmännen SW Seed



SLU
NL-Faculty
 Department of Soil and Environment
 Department of Plant Biology and Forest Genetics
 Department of Urban and Rural Development



Knowledge grows

SL-Foundation



A wide-angle photograph of a vast field of yellow flowers, likely rapeseed or mustard, stretching to the horizon under a clear blue sky. The flowers are in full bloom, and the field is densely packed. The text "Thank you for your attention!" is overlaid in white on a semi-transparent dark background at the bottom of the image.

Thank you for your attention!