POSHMyCo - Potential of selective harvest based on mycotoxins content assessment in cereal crops

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2019 cofunded Call
End-term Project Seminar
30th January 2024, Warsaw, Poland

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Involved countries and partners

6 partners in 5 countries: Belgium, Greece, Lithuania, Spain, and Sweden.

Duration: 36 + 6 months

Overall budget: 741.9 K€

UGent, BE
Coordinator

VMU, LI

AUTH, GR

SLU, SW

US, SP

Agrosap, SP

Objective

- Problem:
  - Fusarium head blight (FHB) induced mycotoxin in cereal crops impacts food and fodder safety, and economic return.

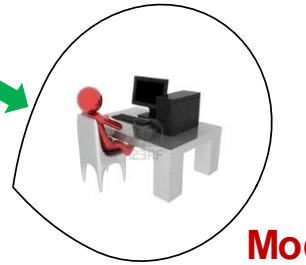
- Solution:
  - A multi-sensor, data fusion approach for detecting and forecasting FHB and mycotoxin spread in the field for reducing the risk of mycotoxin contamination in wheat and barley grains by preventive site specific spraying (PSSS) and selective harvest (SH).

- Aim:
  - Development of a fully automated ICT-based solution to reduce the mycotoxin contamination in food and fodder, which is expected to maximize the yield price, while minimize the risk to human health and livestock.

Selected research approach, methodology

Sensing

Cloud intelligence



Modelling

Weather data

DON prediction

FHB forecasting

PSSS

SH

Control

Selected research approach, methodology

FHB and DON prediction and mapping:

- A hyperspectral camera (400-1000 nm)
- Artificial Neural Network to predict FHB %
- Machine learning models to correlate DON and FHB %.

FHB forecasting :

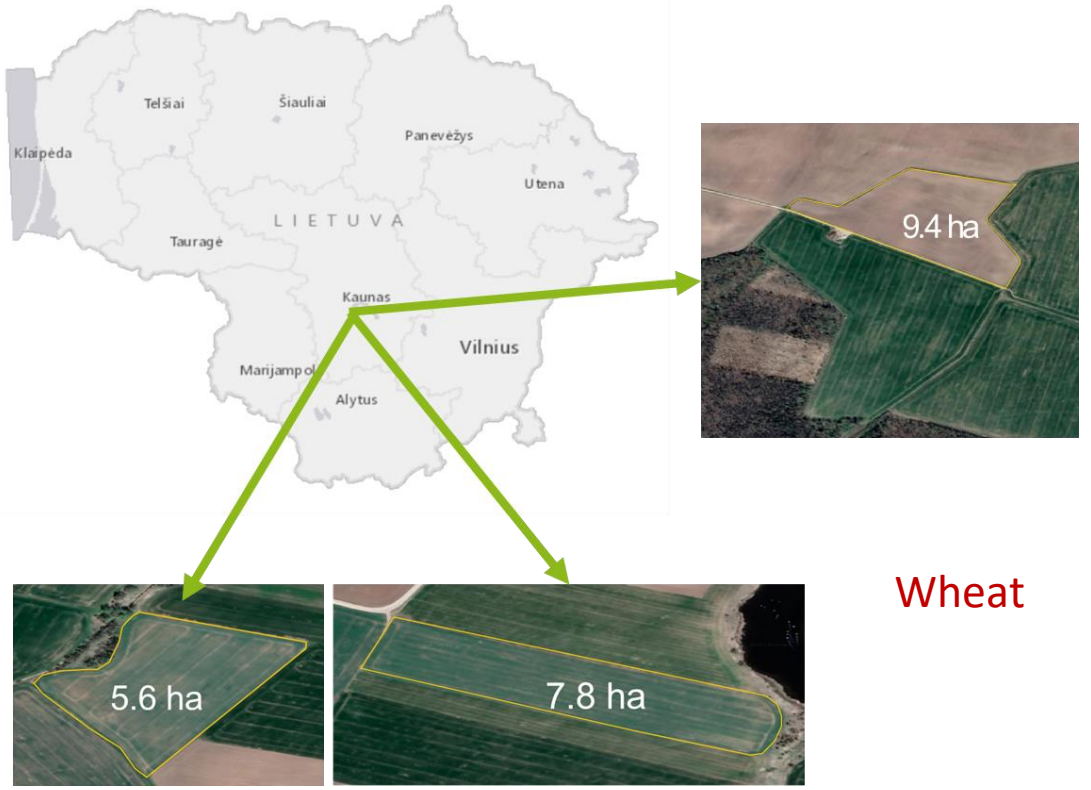
Machine learning, using soil properties, NDVI, LAI, Chl, and relative humidity.

Recommendation maps for PSSS:

Derived from FHB forecasting models

Route planning maps:

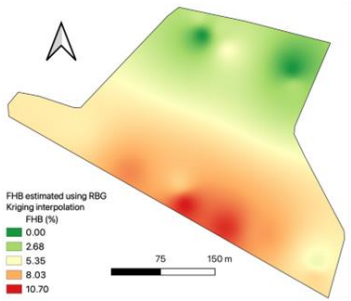
Selective harvesting based on different zones classified regarding its potential mycotoxins content



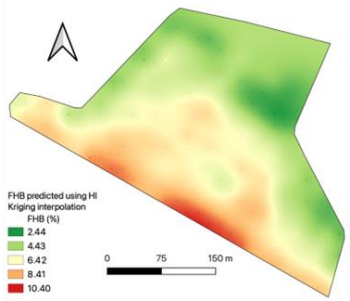
Wheat

Major results: Prediction of FHB and corresponding DON

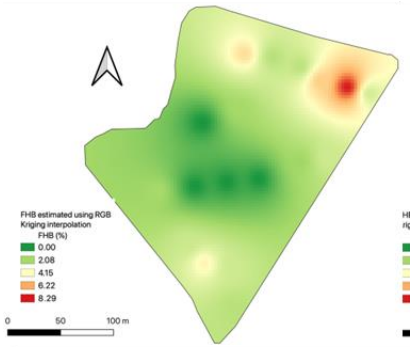
Ground truth



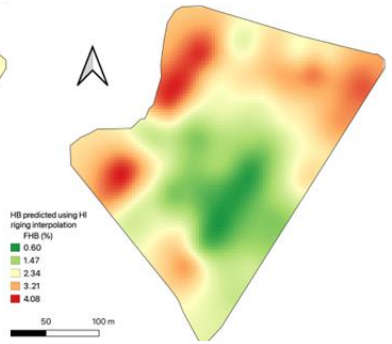
Online prediction



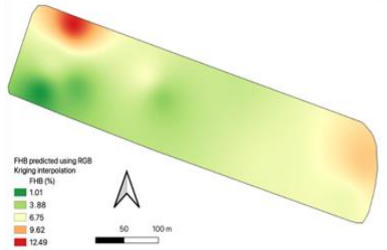
Ground truth



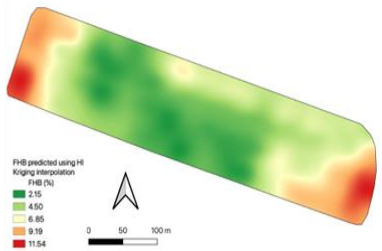
Online prediction

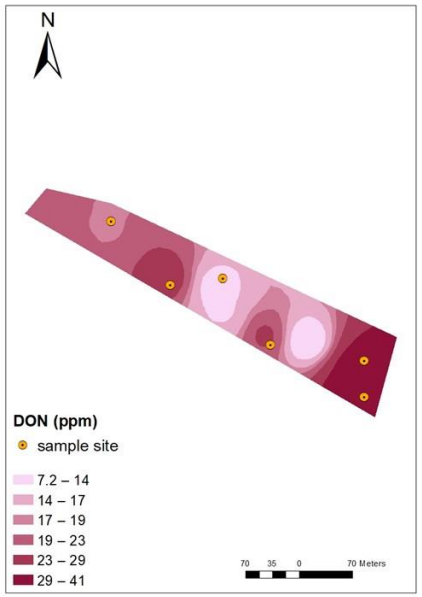


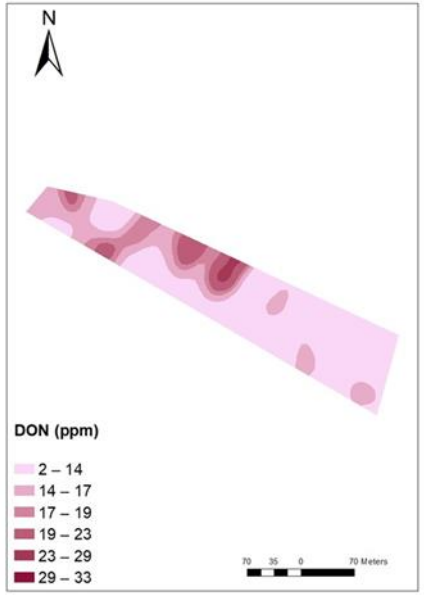
Ground truth

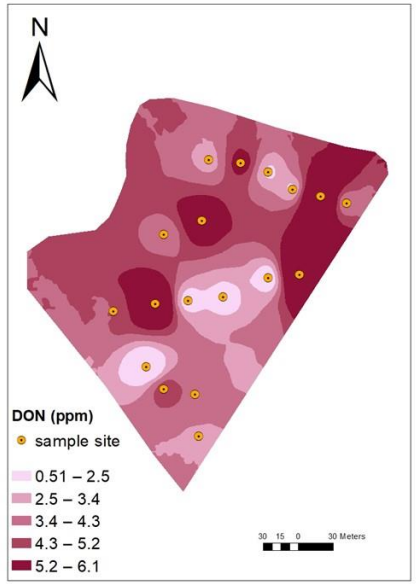


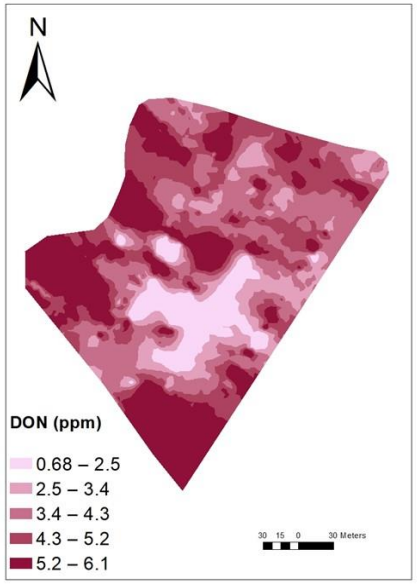
Online prediction

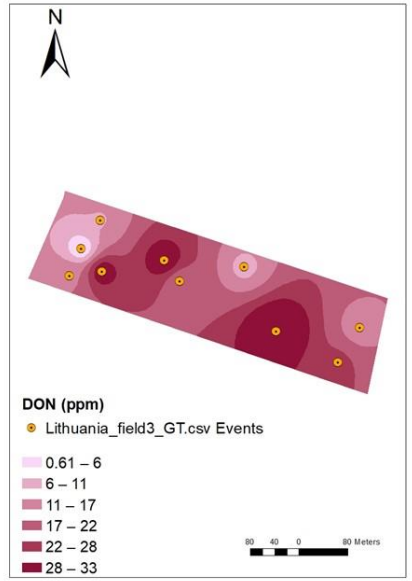


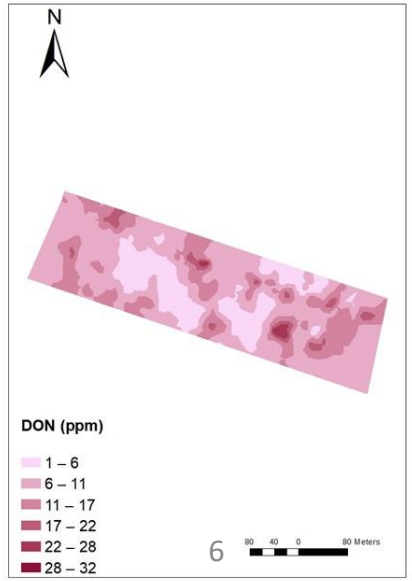




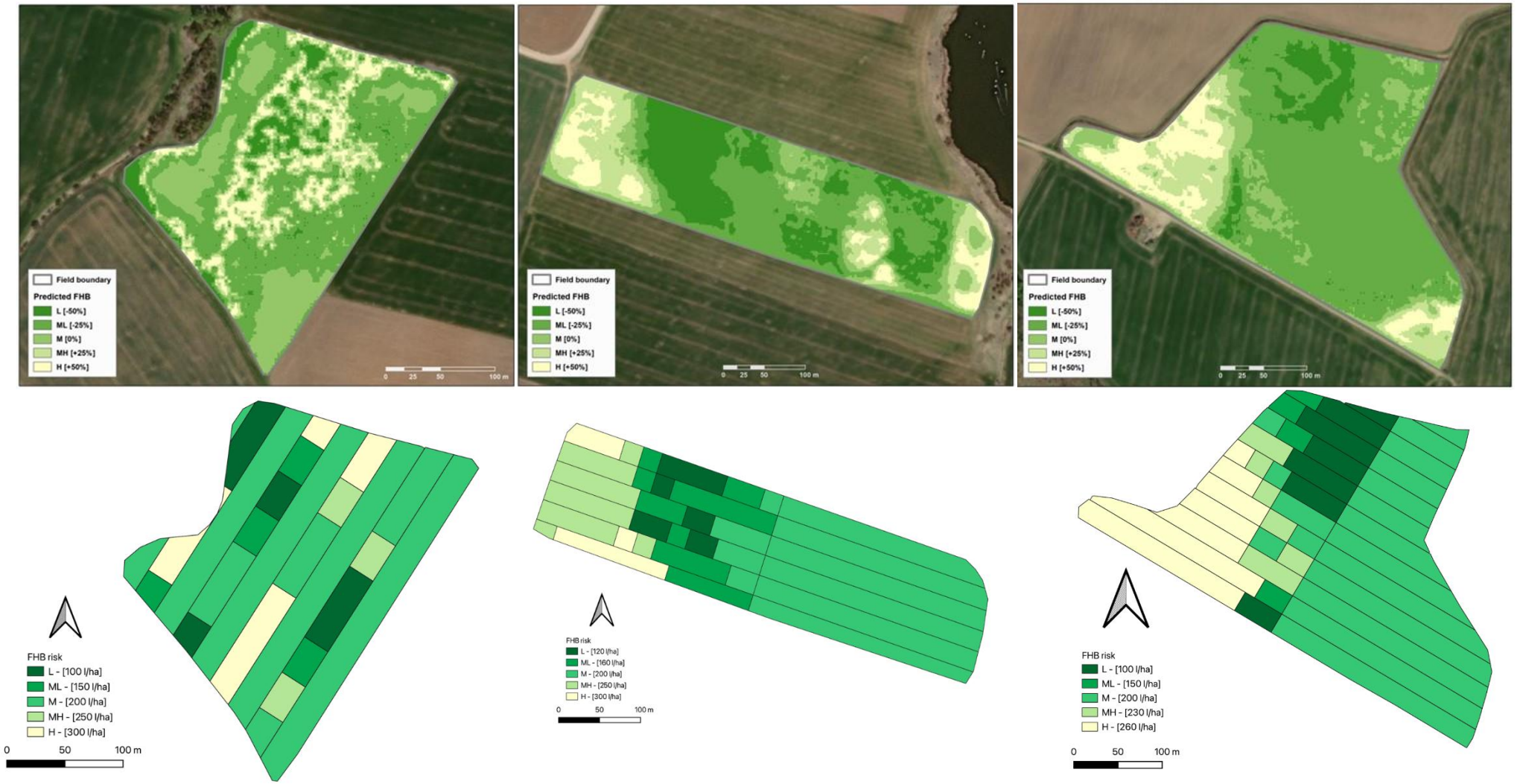






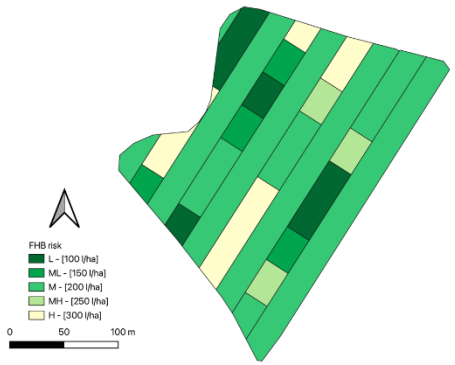


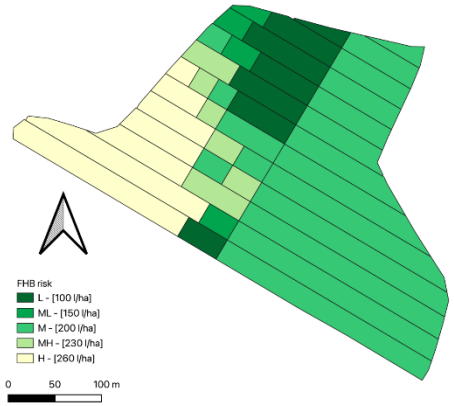
Major results: FHB forecasting and PSSS application

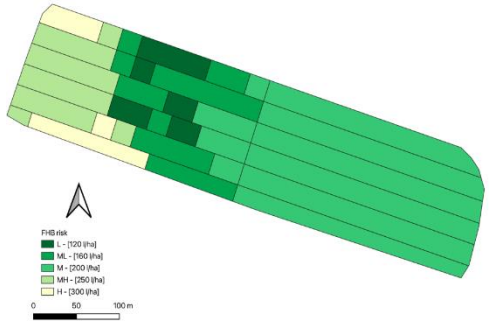


Major results: Cost-benefit analysis of PSSS

	Field 1						Field 2						Field 3					
	Total area (ha)	Fungicie cost (€/ha)	yield (t/ha)	Revenue (€/ha)	Gross margin (€/ha)	Relative gross margin (€/ha)	Total area (ha)	Fungicie cost (€/ha)	yield (t/ha)	Revenue (€/ha)	Gross margin (€/ha)	Relative gross margin (€/ha)	Total area (ha)	Fungicie cost (€/ha)	yield (t/ha)	Revenue (€/ha)	Gross margin (€/ha)	Relative gross margin (€/ha)
UR	2.58	25	7.47	1755.1	1730.1	**- 48.9**	4.80	25	8.58	2016.4	1991.4	**84.1**	3.80	25.00	7.15	1679.2	1654.2	**100.4**
VR	2.34	25.08	7.26	1706.2	1681.1		4.37	24.9	8.94	2100.4	2075.5		3.82	25.42	7.57	1780	1754.6	



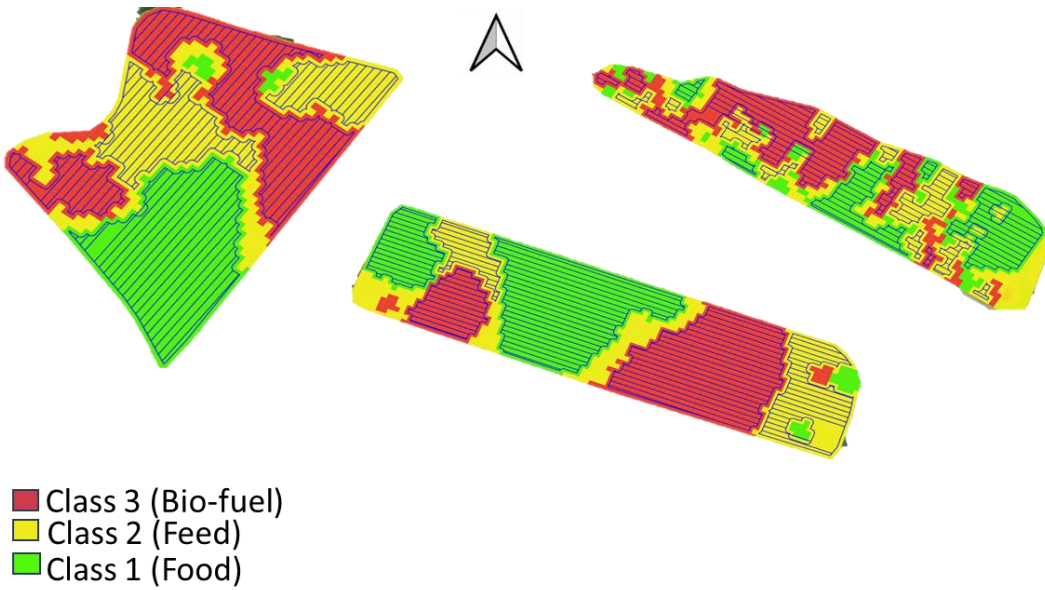




- Wheat fields in Lithuania
- 2023 cropping season

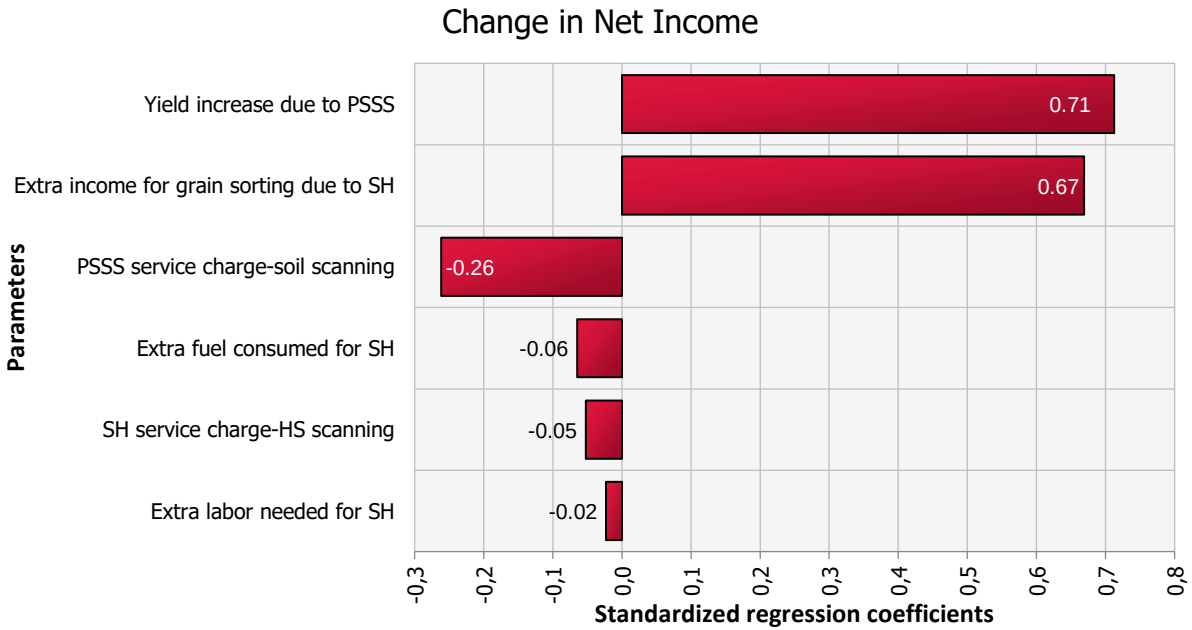
Major results: Simulation cost-benefit analysis of SH

Added income due to change	Value (€)	Added costs due to change	Value (€)
Extra income for grain sorting due to SH	64	SH service charge-HS scanning	5
		Extra labor cost for SH	2
		Extra fuel cost for SH	6
Total added income	64(8)	Total added cost	13(6)
Reduced costs due to change	**Value (€)**	**Reduced income due to change**	**Value (€)**
	-	-	-
Total reduced cost	0(0)	Total reduced income	0(0)
Increase in net income	**64(8)**	Decrease in net income	13(6)
Change in net income	**51(18)**		

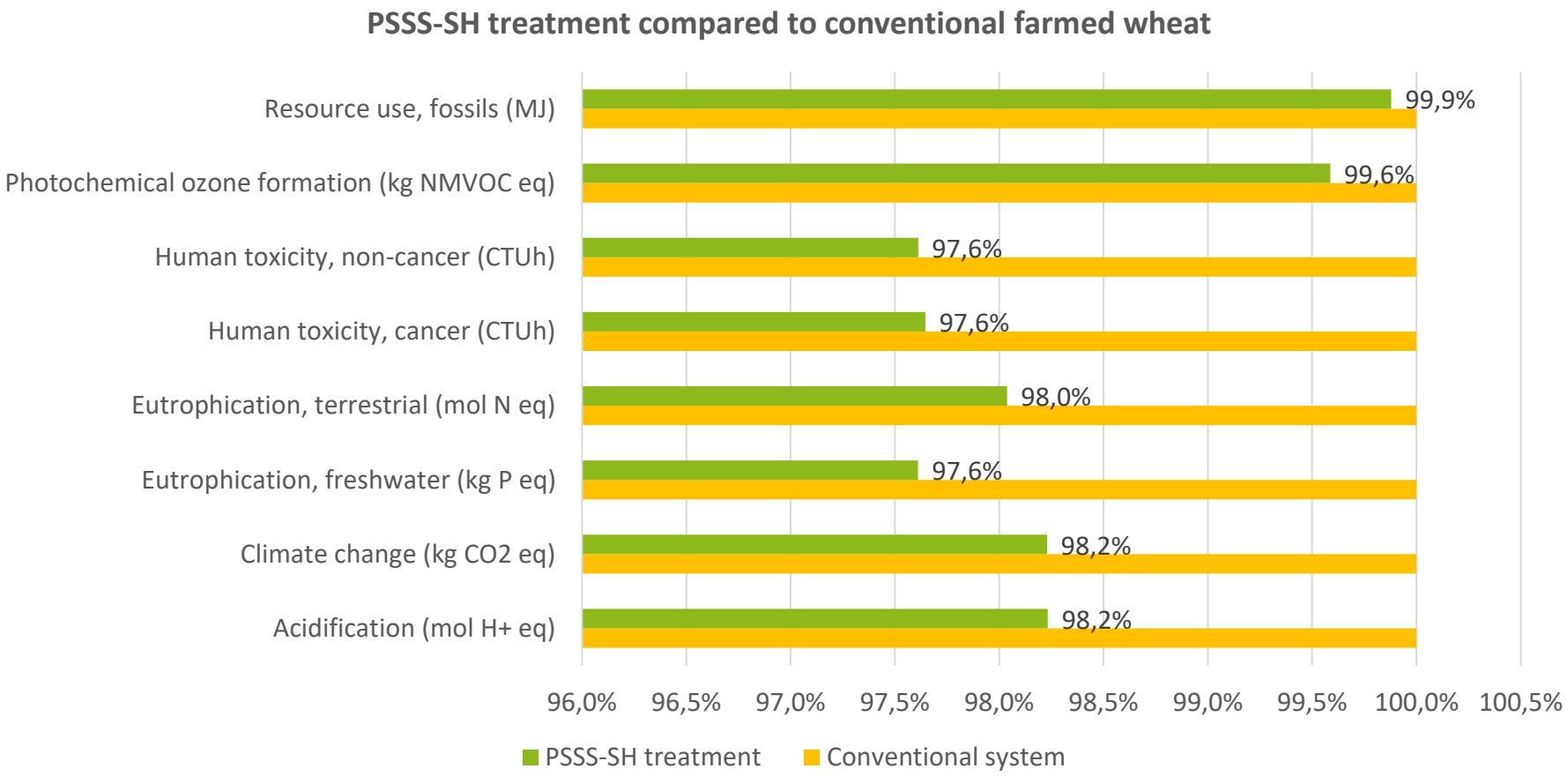


Major results: Cost-benefit analysis of SH & PSSS

Added income due to change	Value (€)	Added costs due to change	Value (€)
Yield increase due to PSSS	68	PSSS service charge-soil scanning	25
Extra income for grain sorting due to SH	64	SH service charge-HS scanning	5
		Extra labor cost for SH	2
		Extra fuel cost for SH	6
Total added income	132(20)	Total added cost	38(2)
Reduced costs due to change	**Value (€)**	**Reduced income due to change**	**Value (€)**
	-	-	-
Total reduced cost	0(0)	Total reduced income	0(0)
Increase in net income	**132(30)**	Decrease in net income	38(2)
Change in net income	**94(20)**		



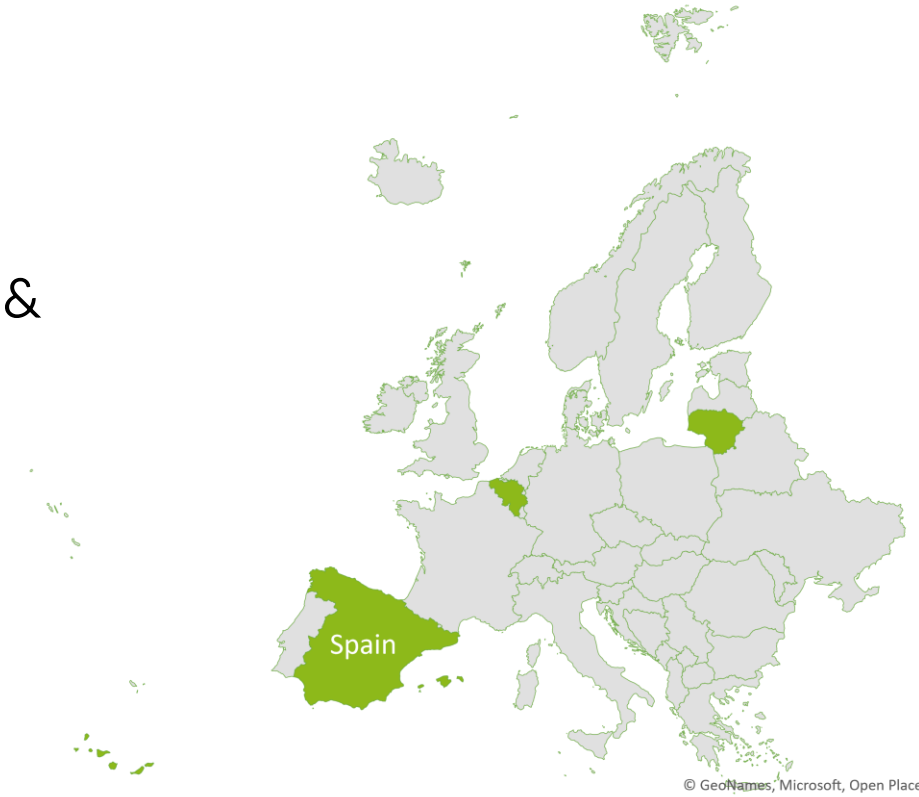
Major results: Life Cycle Analysis (LCA)



Cooperation with stakeholders, industry partners and/or public and private sector

• One industry partner from Spain (Agrosap), interested to commercialize the integrated solution as a service provider.

• Three private commercial farms in **Lithuania** & one commercial farm **in Belgium**



Opportunities and next steps for innovation

1. Pilot testing in different Regions
   - ✓ Conduct pilot tests of the POSHMyCo solution in different geographical regions.
   - ✓ Recommend more robust tailor-made recommendations based on future feedback of pilot tests.

2. Drone Technology
   - ✓ Use drones to map the spatial variability of key attributes including FHB and mycotoxin, and for precision spraying of fungicide.

3. Commercialization and Market Expansion
   - ✓ Explore avenues for commercialization of the developed technologies. Consider developing a business model that can sustain the project's impact and ensure its financial viability.

4. Training and Capacity Building
   - ✓ Organizing training programs for farmers and other stakeholders on the use of the developed tools and recommendations of POSHMyCo.

Summary and Conclusion

1. Technology

- ✓ Integrated solution for FHB and corresponding DON mycotoxin prediction and mapping.
- ✓ Development of preventive site-specific fungicide spraying (PSSS) based on FHB forecasting.
- ✓ Development of route planning for Selective Harvesting (SH) based on DON prediction.

2. Economic impacts:

Increased profitability by increased yield:

- ✓ PSSS-SH (Simulated): ≈ **94 €/ha/yr** net income, compared to conventional system.

3. Environmental impacts:

- ✓ Reduction of **-1.8%** CO_2eq and **-2.4%** of human toxicity with PSSS+SH (simulated), compared to the conventional system.

LET'S KEEP IN TOUCH!

Please feel always free to reach out to us.

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Thank you for your attention!