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Pesticide use reduction with alternative biodiversity-friendly practices: a case study in Switzerland

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Research project ?

Research – Action project ?

Action – Research project ?

Action project ?

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Approach and Concept

- Principles of agroecology
  - Producing based on ecosystem functionalities
  - Maximising functional biodiversity
  - Strengthening biological regulation in agroecosystems
  - Optimising ecological processes and interactions between organisms in the agroecosystem → Sustainable optimisation of ecological functioning





Agroecological plant protection

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Plant protection

From integrated … towards … agroecological

Improved chemical action and beneficial insect promotion
Milder alternatives

Global strategy for the control of harmful organisms
New conception of the crop system

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Agroecological plant protection

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- Partly known: Effect of alternative prevention and control practices ....

BUT ...

- Missing: Implementation of the alternatives' combination and promotion of ecosystem services
- All noxious organisms - diseases, weeds and pests – together to all crops in the rotation → synergies, tradeoffs
- Systemic and holistic approach of the crop rotation = combine control methods and use prophylactic levers, tolerate damage

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The particular project “PestiRed” in Switzerland

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- **Decrease of 75% synthetic chemical pesticide use (insecticide, fungicide, herbicide) along the whole crop rotation**
  - **Treatment frequency index (TFI), number of interventions, active ingredient per ha, toxicity**
- **Yield reduction 10% at maximum**

→ Challenging !

- **Reference values:**
  - **Control fields with standard practices**
  - **Region specific level at project start**

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Alternative prevention and control practices

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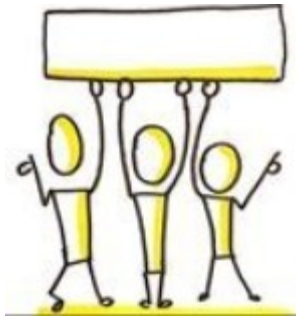

Mechanical stubble cultivation | Intercropping | Mechanical weeding

Tillage | Cultivars | Crop residue shredding | Optimized seeding | Drift | Push-Pull

Mech. potato vines destr. | Fertilization | Precision farming | GPS seeding

False seed-bed | Partial surface treatment | Threshold / forecast | Undersowing

Antagonists & medicinal plants | Wild flower strips | Cover crops

Combination of measures

Farmers - Extension – Scientists

Adaptation

Recomm-andation

Crop 1 | Crop 2 | Crop 3 | Crop 4 | Crop 5 | Crop 6

Diversified crop rotation 6 years

Monitoring 6+2 years

2019 — 2026

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Design

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In 67 lighthouse – conventional – farms: VD[15, 16, 9] GE[8] SO[19]

1 agroecological field
Alternative practices

1 control field
Standard practices

Monitoring Practices
Treatment Frequency Index
Yield
Monitoring noxious organisms [weeds, diseases, pests]

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Innovation cycles

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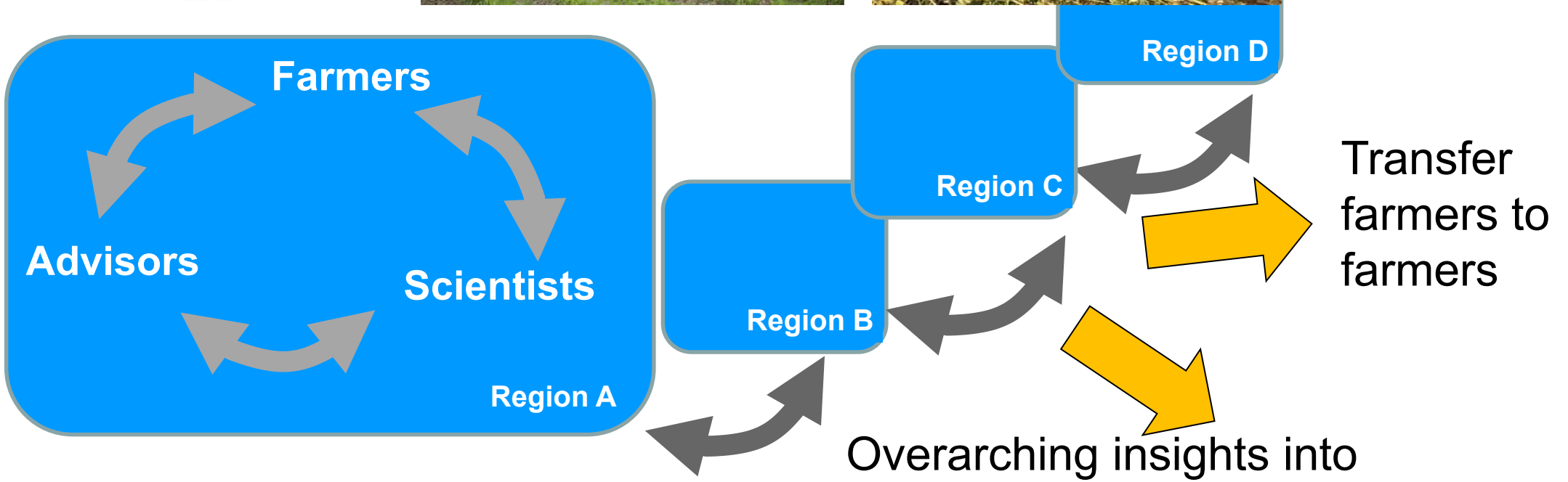

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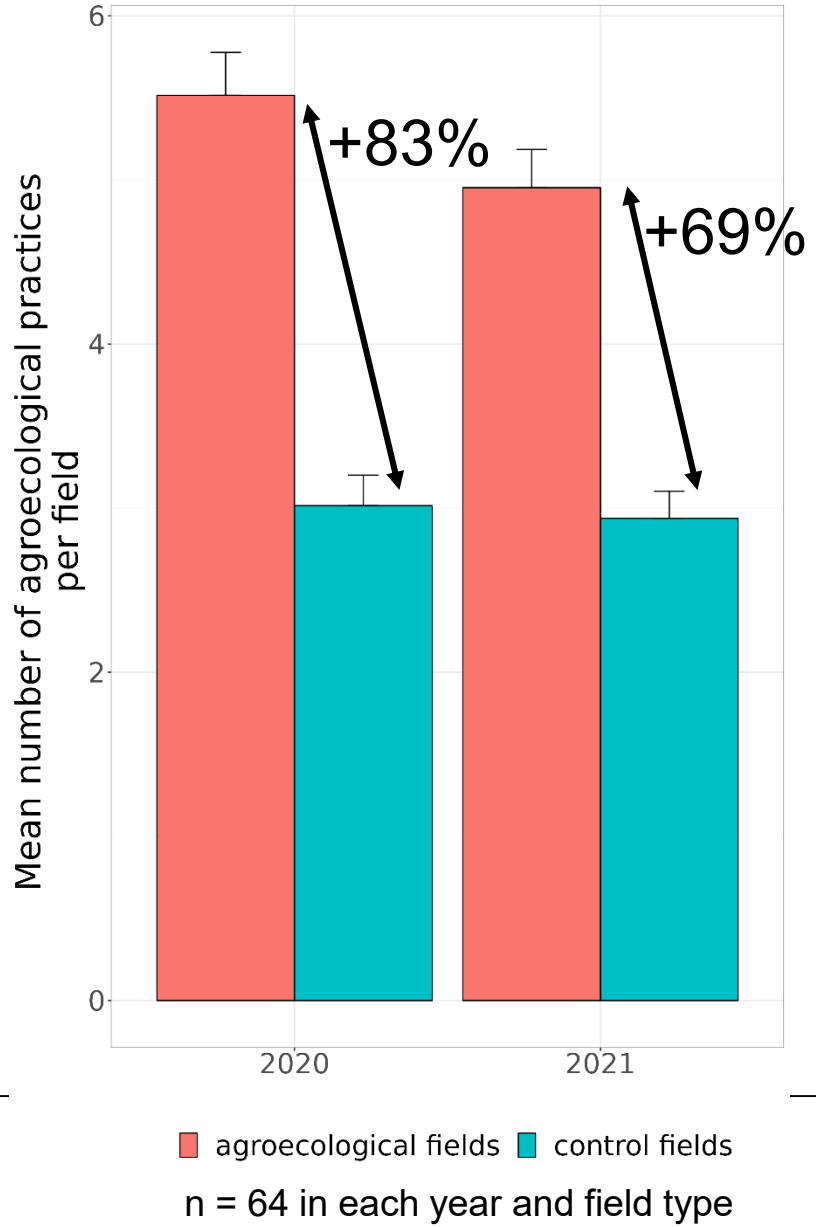
After two main crops in the rotation (2020, 2021) …

- Agroecological practices: 21
- How innovative are the practices ?
- Sometimes also used in the control fields, but …
  - on average 83% and 69% more agroecological practices in agroecological fields



n = 64 in each year and field type

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Treatment frequency index (TFI)

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Crop (# fields agroecology & control 2020-2021, # reference fields 2017-2019)	Reduction TFI agroecology / control (2020-2021)	Reduction TFI agroecology (2020-2021) / reference (2017-2019)
Bean (9, 5)	100%	100%
Corn (18, 29)	94%	94%
Winterwheat (26, 61)	93%	94%
Oilseed rape (18 , 28)	86%	88%
Barley (20, 15)	82%	84%
Soja (4, 7)	79%	79%
Spelt (7, 8)	74%	90%
Sunflower (6, 12)	58%	82%
Sugarbeet (5, 11)	47%	85%
Potato (4, 7)	33%	37%

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Agronomic and economic yield – first estimations

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Crop[a]	Number of farms[b]	Agroecological plot (I)	Difference in VCM	Control plot (C)
Wheat	13	I	≈	C
Oilseed rape	4	I	≈	C
Sunflower	3	I	≈	C
Fodder barley[c]	4	I	<	C
Potato	4	I	<<<	C
Spelt	3	I	<<<	C

Table. Variable cost margin (VCM) differences in the first year of the project (2020): ≈ +/-10%, < -10 to -20%, << -20 to -30%; <<< -30%.

[a]Artificial grassland, grain and silage maize, pea-barley mixtures and sugar beet are not represented.
[b]Only farms that provided final prices were considered.
[c]Malting barley and seed barley were not taken into account (different sales prices).
Flower strips were included in the final VCM in Fr./ha.

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More pests in agroecological fields ?

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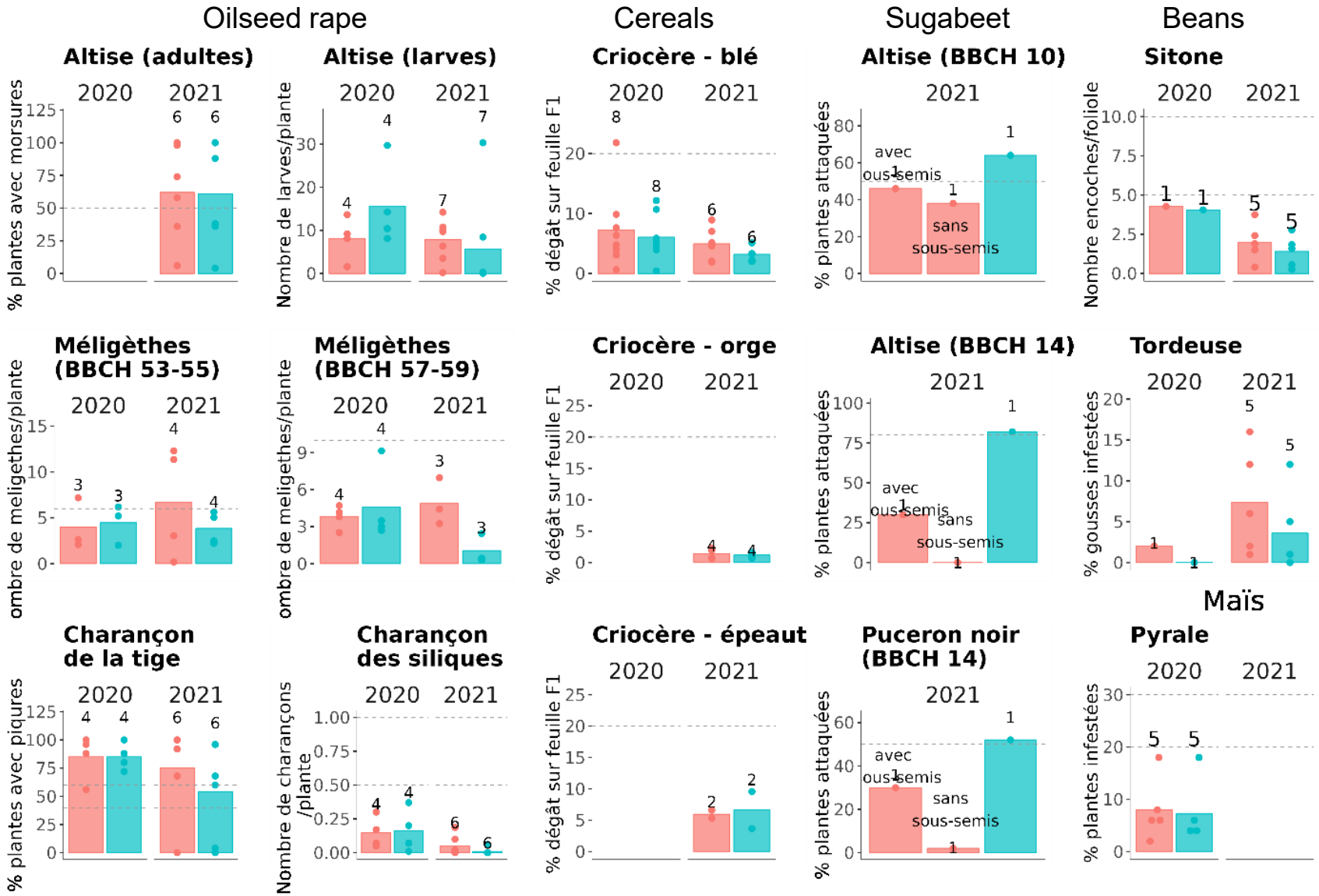

- No big differences between the field types
- Still effect of undersowing in one sugarbeet field

More natural ennemies in the agroecological fields ?

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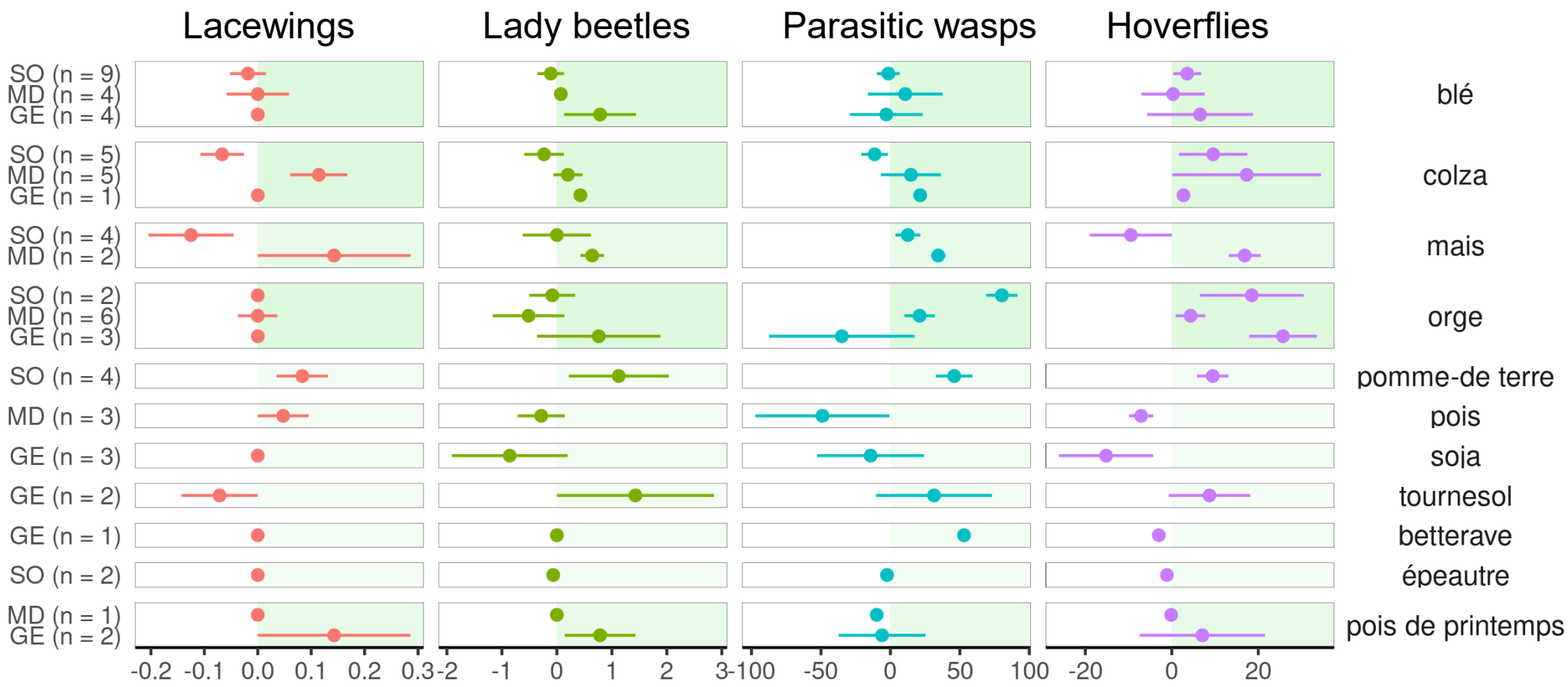
Delta plot agroecological versus control fields



Average per field, week and year of sampling

Mean lacewings = 0.17, lady beetles = 3.5, parasitic wasps 75, hoverfly = 64 individuals

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Outlook

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- Identify best preventive and alternative practices
- Analyse the context – crop rotation, landscape
- Identify most efficient systems on an ecological and economic point of view
- Analyse farmer acceptance or refusal to adopt

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Outlook

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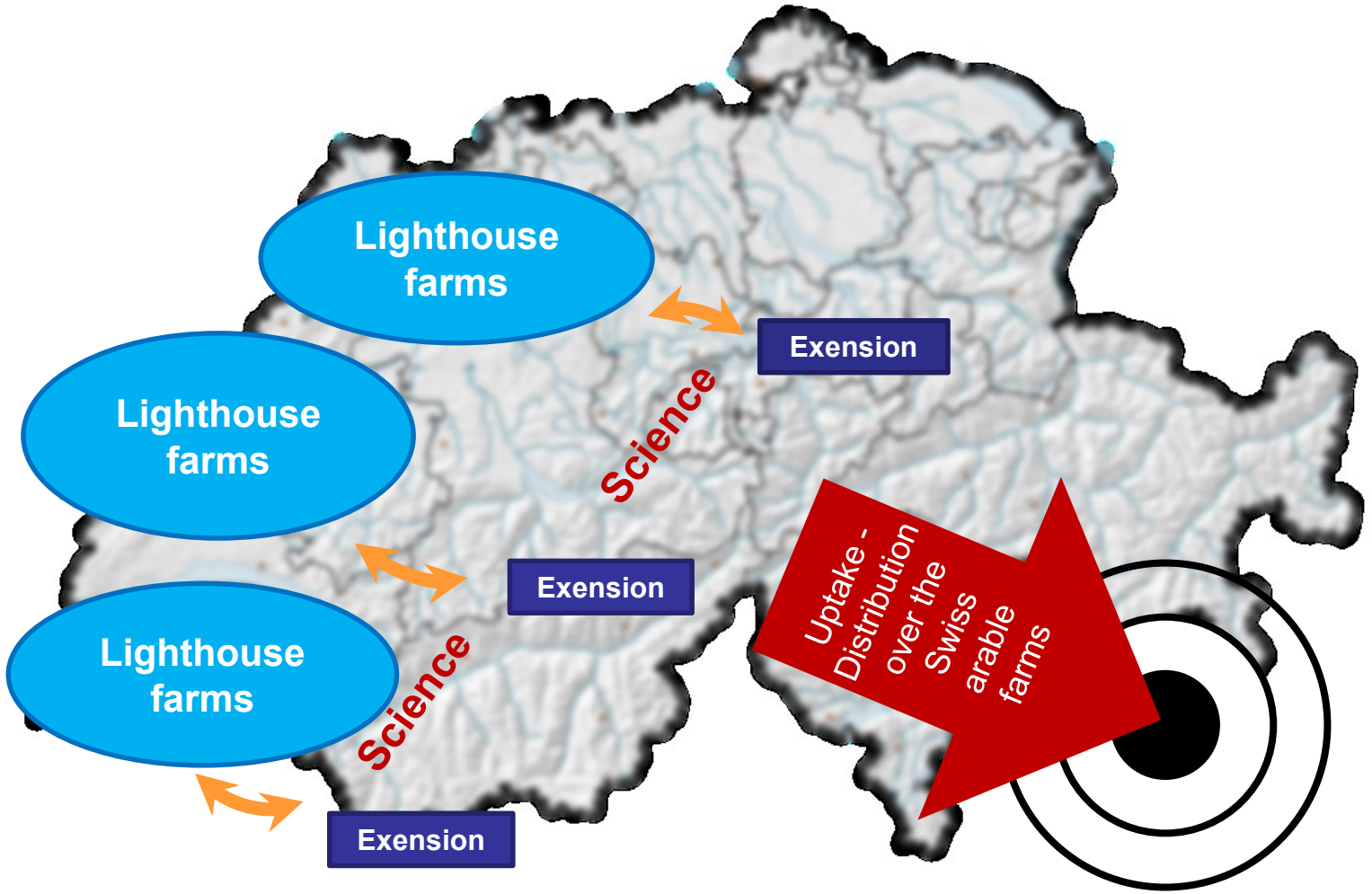

Partners

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- IP-Suisse: M. Lüthi, J. Demierre, J. Scheidegger
- Kantone:
  - SO: S. Bader, G. Mori, A. Wyss, U. Kilchenmann
  - VD: O. Viret, N. Dériaz
  - ProConseil: Ch. Savoyat, D. Martin, E. Cholley, V. Ménétrier
  - GE: D. Fleury
  - AgriGenève: N. Courtois
- Agridea: E. Correa-Bovet
- Fenaco: M. Hämmerli, M. Feitknecht
- SVB: D. Brugger
- HAFL: B. Streit
- Nestlé Waters: F. Davila Alotto

Stakeholder and partner institutions

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Prométerre
Association vaudoise de promotion des métiers de la terre

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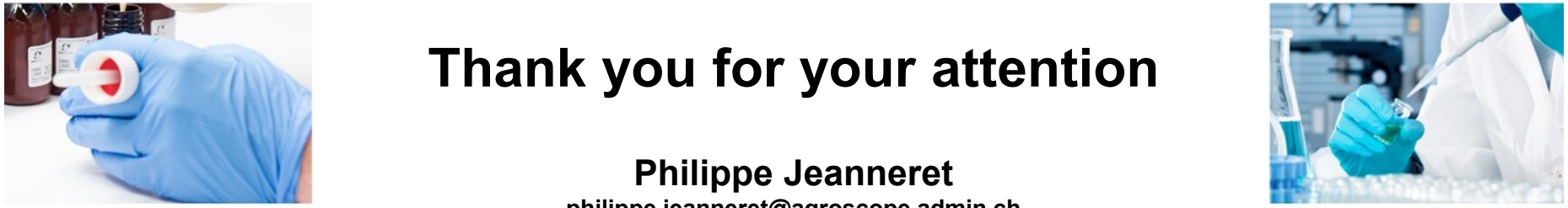
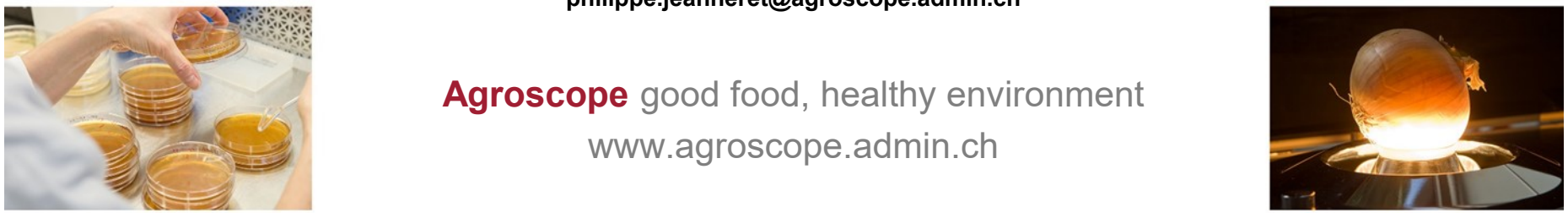

Thank you for your attention

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