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Agroscope

Alternative plant protection strategies in apricot growing from agronomic, economic, environmental and social perspectives

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INTRODUCTION

Plant protection products (PPh) in agriculture: a political and social issue (several popular votes against PPh in CH)

In Switzerland, obligation to reduce the risks arising from the use of PPh by 50% by 2027 (by 2030 in EU, Green Deal)
→ Search for new crop protection strategies

ArboPhytoRed project
→ Testing new plant protection strategies (apple, pear and apricot) with lower use of synthetic PPh and PPh with particular risk potential

→ Sustainably improve the positive impact of plant protection on natural resources (water, soil, biodiversity, etc.)

INTRODUCTION

ArboPhytored project (2021-2026)

- **Reduce the use of synthetic PPh and PPh with particular risk potential by at least 30%**
- **Limit yield and financial losses to less than 10%**

- **Mandatory measure: no herbicide**
- **Two supplementary measures : alternative fungicide and/or alternative insecticide measures**

- **Participative approach**
- **Contributions directly to farmers to test alternatives**
- **Setting up on-farm trials in 38 apricot orchards**

- **Study of different performances: agronomic, economic, environmental and social**

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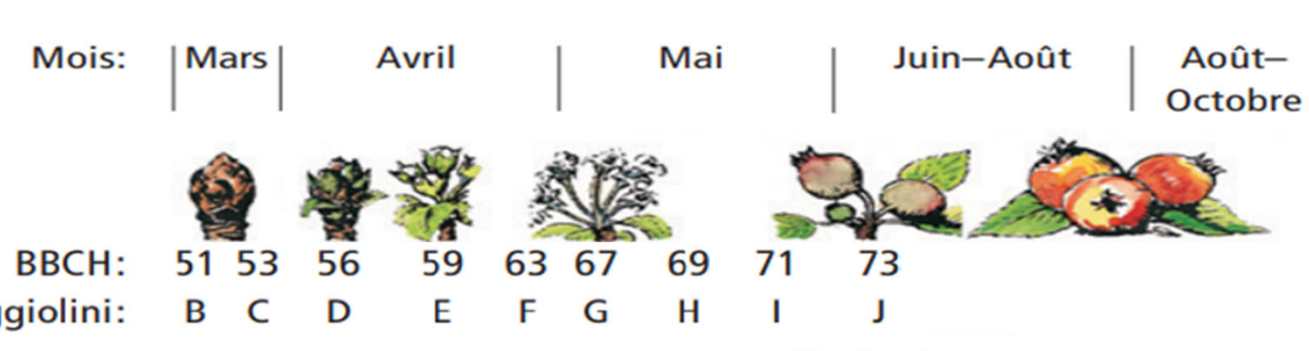
Different levels of measures

Herbicide



All products

- *with risk potential*
- *synthesis*
- *organic products (except copper)*

2 types authorised

- *synthesis*
- *organic products (except copper)*

1 type authorised

- *organic products (except copper)*

MATERIALS AND METHODS

Various monitoring and data analys depending on the performance
<u>Alternative vs. standard strategy</u>

Agronomic performance

- **Visual controls for diseases and pests in 38 plots (innovative and control)**
- **Counting presence (1) / absence (0) then comparison with tolerance thresholds**
- **100 organs (leaves or inflorescences) or 1000 fruits**
- **Monitoring at key times: 1 post-bloom, 2 summer and 1 at harvest.**
- **Several varieties (13) : Apridélice, Aprisweet, Bergarouge, ...**

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RESULTS AND DISCUSSION

Agronomic performance

1. Green aphids

2021: heavy presence from the post-flowering stage (cool, wet weather conditions
→ Conventional strategies more effective than alternative strategies

2022-2023: low pressure (hot, dry weather conditions)
→ Conventional and alternative strategies are equally effective, with some exceptions.

		2021			2022			2023		
Operator	**Measures**	**Post-Floral**	**May**	**June**	**Post-Floral**	**May**	**June**	**Post-Floral**	**May**	**June**
A	I1	12	34	0	1	0	0	-	-	-
	Indicator	4	6	0	1	0	0	-	-	-
B	I3	11	74	0	8	7	21	14	62	0
	Indicator	2	61	0	11	0	1	1	0	1
C	I3	58	12	0	0	0	3	0	7	-
	Indicator	24	33	0	0	0	0	0	10	-
F	I3	23	31	84	0	22	1	-	-	-
	Indicator	3	8	71	0	3	5	-	-	-
					1 exception: 1x synthetic PPh					
D	I3	n.i	n.i	n.i	0	0	0	0	0	0
	Indicator	n.i	n.i	n.i	0	0	1	0	0	1
E	I3	n.i	n.i	n.i	0	1	9	0	0	0
	Indicator	n.i	n.i	n.i	0	2	2	1	0	1
	Thresholds	**2 - 5%**	**3 - 10%**	**3 - 10%**	**2 - 5%**	**3 - 10%**	**3 - 10%**	**2 - 5%**	**3 - 10%**	**3 - 10%**

Rate of green aphid presence in apricot orchards treated conventionally, alternatively and alternatively with an exceptional synthetic treatment, during post-flower and summer (May and June) inspections in the 2021, 2022 and 2023 seasons. (Varieties not taken into account, "n.i" noted for plots not registered in the year in question)

RESULTS AND DISCUSSION

Agronomic performance

1. Green aphids

Level of protection comparable between alternative and conventional strategies EXCEPT in cases of heavy infestation

→ **«Year effect»**: effectiveness of treatment, environmental conditions, flowering, etc.

→ **«Strategy effect»**: monitoring, thresholds, temperatures, state of foliage, etc.

→ **«Plant effect»**: e.g. vigour, cultivar, etc.

RESULTS AND DISCUSSION

Agronomic performance

2. Shot hole disease

	2021			2022			2023		
Operator	Measure	Innov.	Control	Measure	Innov.	Control	Measure	Innov.	Control
Prod 1	F1	25	7	F1	17	3	F1	1	2.4
Prod 2	F1	12	8	F1	5	2	F1	1	0.2
Prod 3	F1 abandoned	35	5	F1	37	34	F1	0.5	0
Prod 4	F2	24	0	F1	41	28	F1	0.4	0
Prod 5	F2	18	7	F1	12	14	F1	1.6	0.3

Rate of infestation of shot hole disease on apricots during harvest control in the Innovative plots (alternative PPh used post-flower (F1) and pre-flower (F2)) and Control plots of the ArboPhytoRed project at the end of the 2021, 2022 and 2023 seasons. Varieties were not taken into account.

2021-2022: strong fungal pressure → conventional strategies more effective than alternative strategies

2023: low fungal pressure → same level of protection

Success/failure of alternative strategies depending on the level of infestation

MATERIALS AND METHODS

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<u>Alternative vs. standard strategy</u>

Economic performance

- Annual calculation of costs for each modality (alternative vs. control) based on indicators provided by producers

- Various **indicators** are taken into account:

Difference in performance between the two plots (%)

Marketable yields (kg/ha)

Fruit quality (%)

Cost of mechanical weeding

Labour costs (fr/ha)

Production costs (fr/ha)

➢ ***Annual financial result (fr./ha)***

RESULTS AND DISCUSSION

Economic performance

Objective: limit annual yield losses to a maximum of 10%.

2021 : Severe frost damage with a direct impact on harvest yields
→ data exclusion

2022 : -29% of 1st category apricots in innovative plots
(average calculated over 4 producers)

→ Economic target achieved only by 1 out of 4 producers (2022)
→ Results 2023 under study

- Financial analysis at parcel level

MATERIALS AND METHODS

Various monitoring and data analys depending on the performance
<u>Alternative vs. standard strategy</u>

Environmental performance

2 indicators calculated using treatment plans

Number of interventions (TFI): *number of times PPhs were applied during a season*

Quantity of active substances applied: *sum of the quantities of active substances applied per plot during a season (except *)*

PPhs and active substances: synthetic, with a particular potential risk, basic substances, viruses*, bacteria*.

↓

Calculating potential risks to organisms living in surface water

RESULTS AND DISCUSSION

Environmental performance

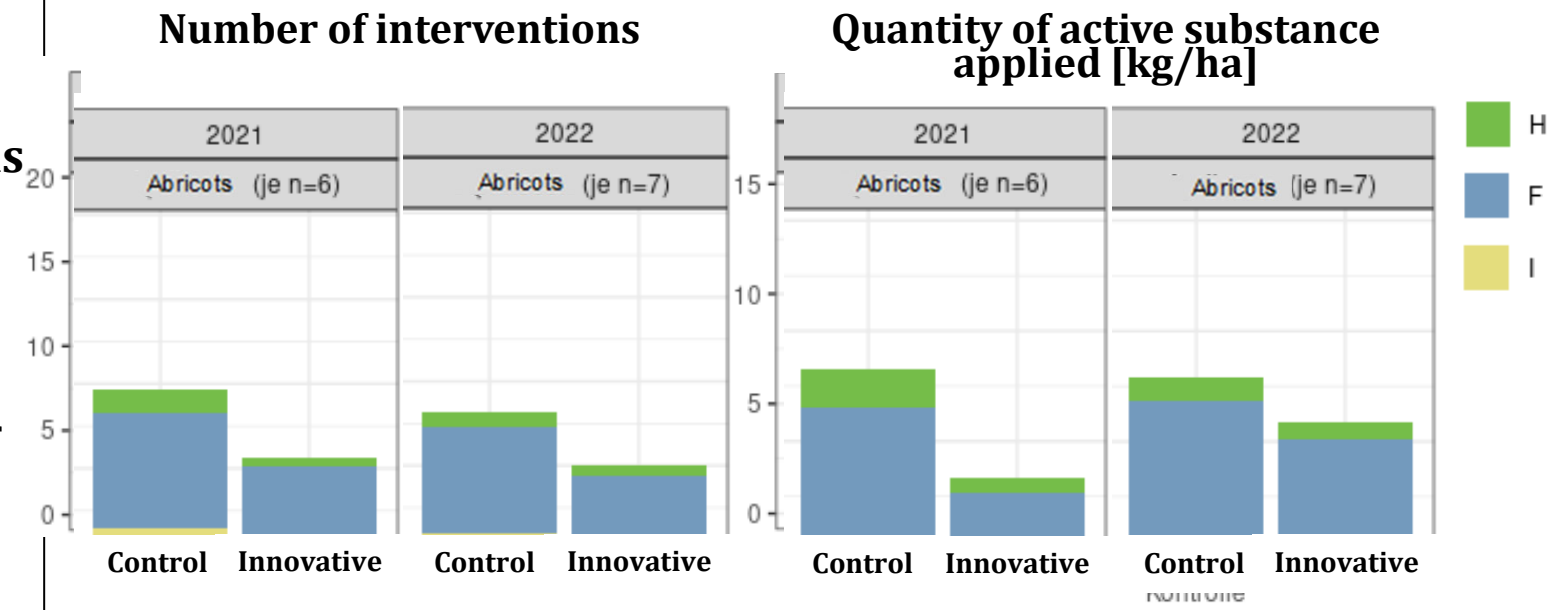
Objective: 30% reduction in synthetic and potentital risk PPhs

Number of interventions (TF-Index)

and

Quantity of active substances

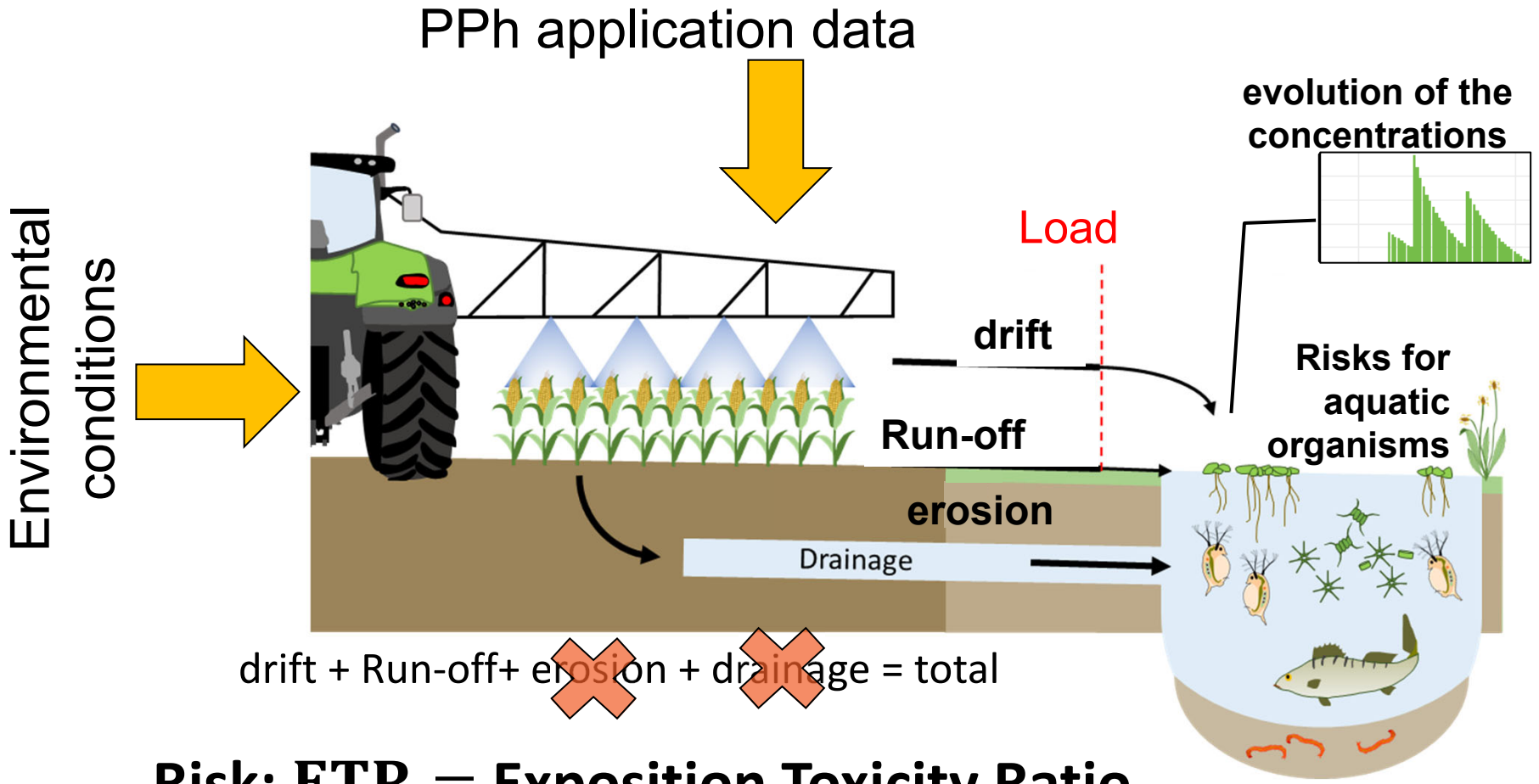
applied per hectare



Average number of interventions and average quantity of active substances applied [kg/ha] of PPh containing synthetic chemical active substances or active substances presenting a particular potential risk on control plots and innovative plots of apricot crops for the years 2021 and 2022.
H = herbicides, F = fungicides, I = insecticides

Herbicide exception in hillsides

Model SYNOPS (not accurate enough for PPh inputs from soil)



Risk: ETR = Exposition Toxicity Ratio

Potential risks for organisms in surface water: -47%

MATERIALS AND METHODS

Various monitoring and data analys depending on the performance
<u>Alternative vs. standard strategy</u>

Social performance

Social monitoring: evaluation of acceptance of measures and any additional social problems

Indicators: work peaks and work organization, staff skills and qualifications, reputation (neighborhood), consideration of citizens' expectations, motivation, reluctance, support).

Conducted using participative meetings

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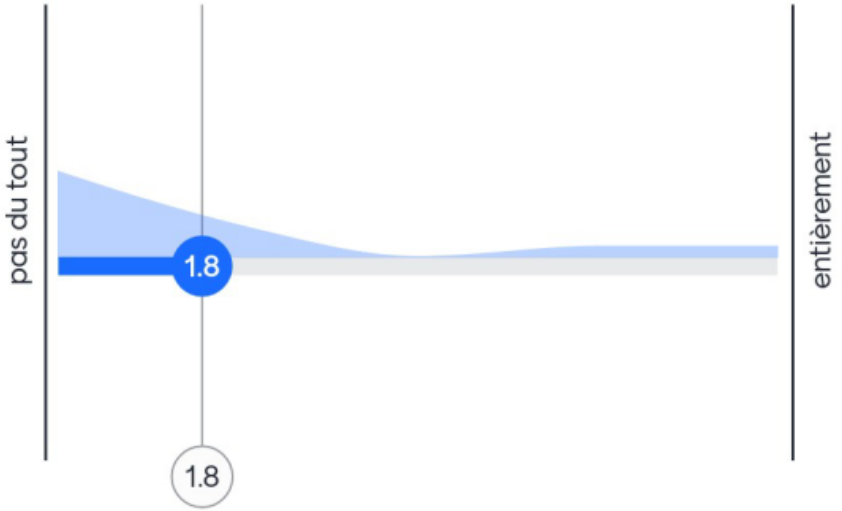
RESULTS AND DISCUSSION

Social performance

Are you satisfied with the APR project in general?

- Time-consuming, Resource-intensive
- Exchanges very appreciated

Are you ready to implement alternative strategies throughout your entire farm?



- Financial risk too high
- Need 45% higher prices

CONCLUSIONS

- Trends of preliminary results
  - **Agronomy**: success/failure of alternative strategies depending on the level of yearly infestation and on the local importance ofpests/diseases
  - **Economic** losses higher than 10%
  - **Environmental** objectives achieved and largely exceeded at the expense of economic performance
  - **Large acceptance** of the farmers (if prices are higher)
    - **Adapting the project to achieve economically viable strategies**
    - **At the end of the project > global orchard performance by merging and prioritizing the 4 performances**
    - **Think new cropping systems**

- **Provocative statements, also from producers…**
  - **Frequency of PP application not so high in apricots**
  - **TF-Index low for apricot**, also in IPM (e.g. compared to apples)
  - **Useful** to produce alternatively for apricots?
  - Active communication on the **progresses already done**?
  - **Copper removal** is too challenging?

BROADER PERSPECTIVES

- **Playing only with alternative PP strategy is not enough**
  - ➢ Integrate other levers, like new cropping systems (training systems, nets, plastics, cultivars…)
  - ➢ Pests and diseases with bio-technical impasses (Pseudomonas, psylla-ESFY, Drosophila, monilia in organic…)

- **Research needs for new epidemiology and forecast models** for pest and diseases (e.g. aphids with climate change? Shot hole with less efficient products, sequential models for multi-trophic pests), **for new knowledge** (e.g. new aphid species?)

- Importance of pests and diseases **highly specific to each region** (e.g. no rust and little mildew in CH)

- **Are the breeding objectives for abiotic stresses more important than for biotic stresses?** (higher impact of frost, hail, warm winter… than of pests and diseases)



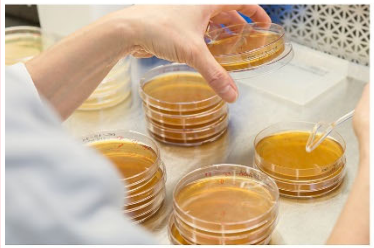



















Thank you for your attention

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