CORE organic DOMINO

BIOFRUITNET

Boosting Innovation in ORGANIC FRUIT production through stronger networks

Living mulches in apple orchards: lessons learned from the CORE organic Project DOMINO

Dr. Michael Friedli & DOMINO project team

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FiBL

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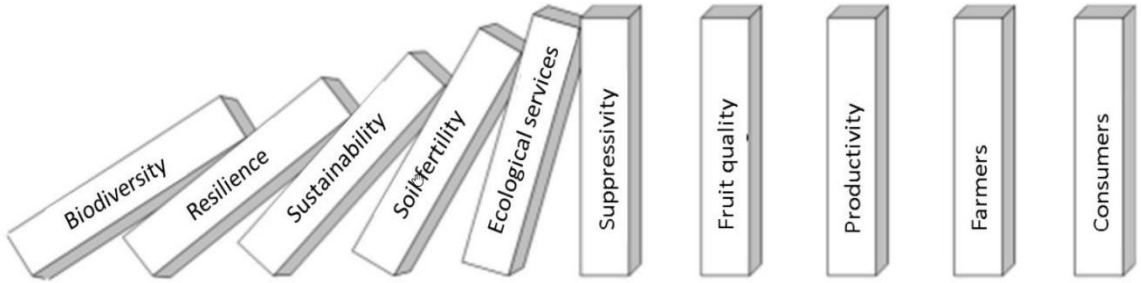
DOMINO

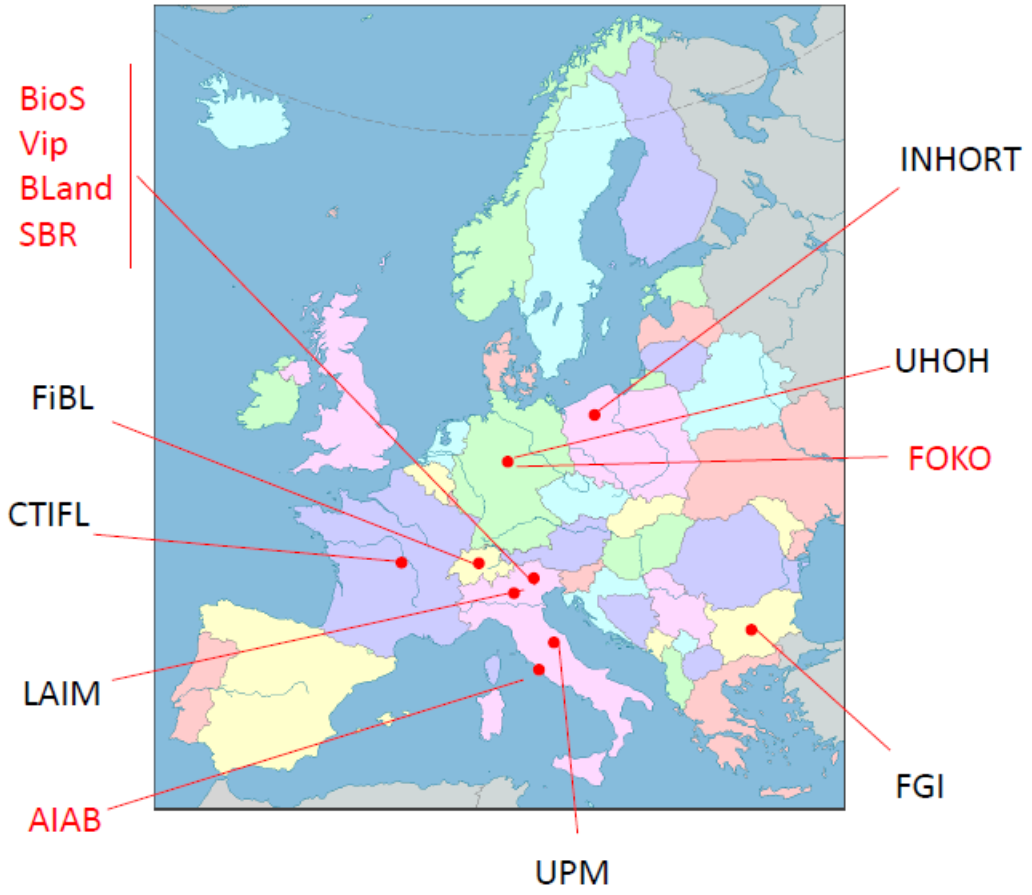


Increasing biodiversity, soil fertility and sustainability of intensively used organic fruit orchards by:

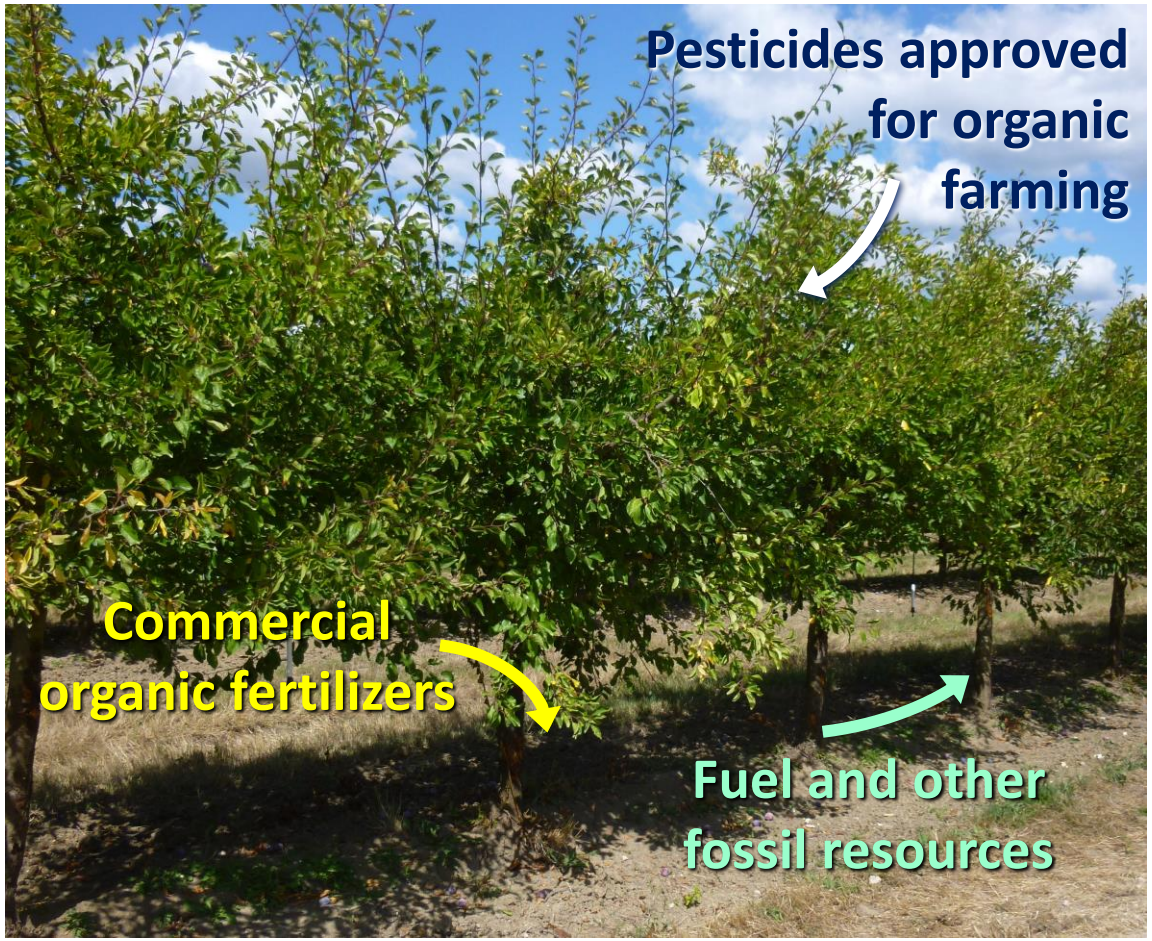
- **living mulch** in the tree row
- optimization of fertilisation strategies using **regionally available recycling fertilisers** and **leguminous intercrops** to improve nutrient balances and ecosystem services
- testing **innovative cover systems** as physical barriers

DOMINO: Project partners

UPM	Polytechnic University of Marche, Italy
FGI	Fruit Growing Institute, Bulgaria
INHORT	Institute of Horticulture, Poland
LAIM	Laimburg Research Centre, Italy
FiBL	Research Institute of organic agriculture, Switzerland
UHOH	University Hohenheim, Germany (Trials at KOB)
CTIFL	Technical centre for fruits and vegetables, France
BioS	BioSüdtirol, Italy
Vip	Vi.P Bio Vinschgau, Italy
Bland	Bioland Südtirol, Italy
SBR	SBR organic, Italy
AIAB	Ass. It. Agricoltura Biologica, Italy
FÖKO	Fördergemeinschaft Ökologischer Obstbau e.V., Germany



Improving biodiversity and reducing dependence on external inputs



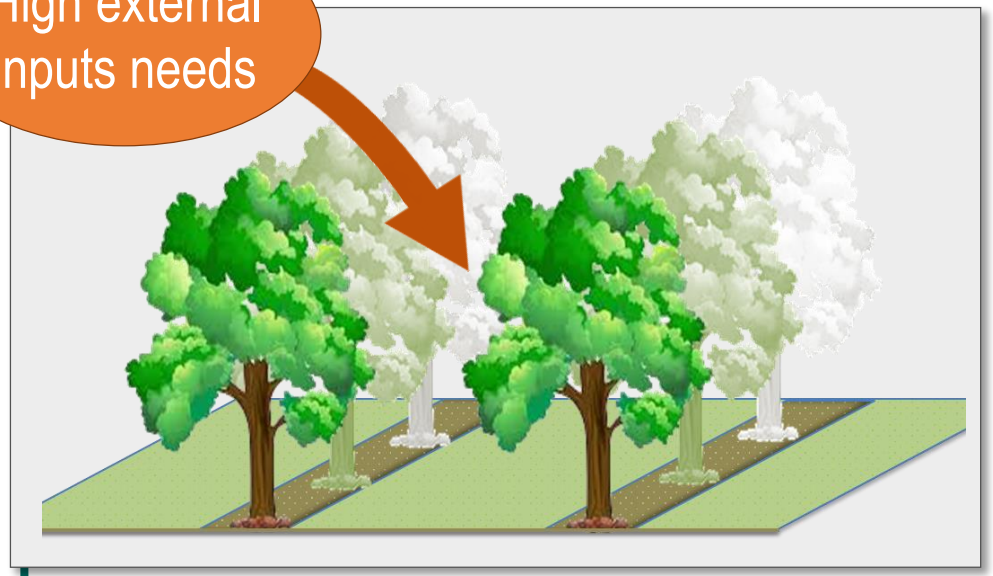
Conventionalization of organic production systems:

Production methods are copied from those of conventional agriculture, with a widespread use of **external inputs** and with the same logics for managing the practices

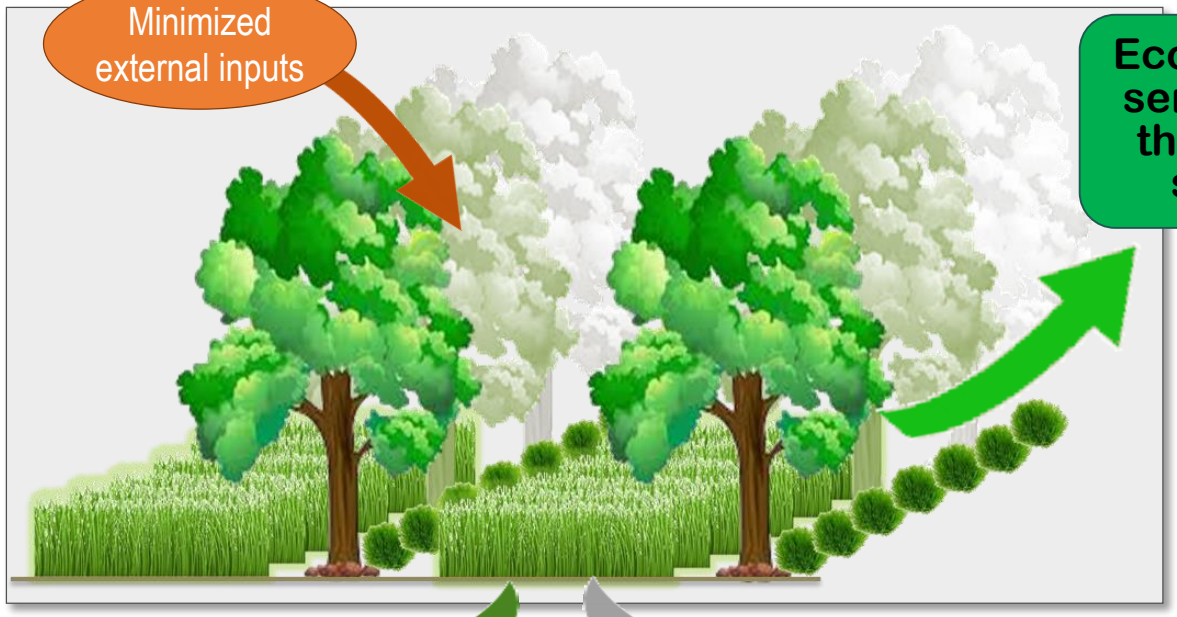
Vegetal biodiversity to redesign the farming system: Towards multidimensional cultivated ecosystems

From a standard organic fruit system → **To a multidimensional cultivated ecosystem**

High external inputs needs



Minimized external inputs



Ecosystemic services for the overall system

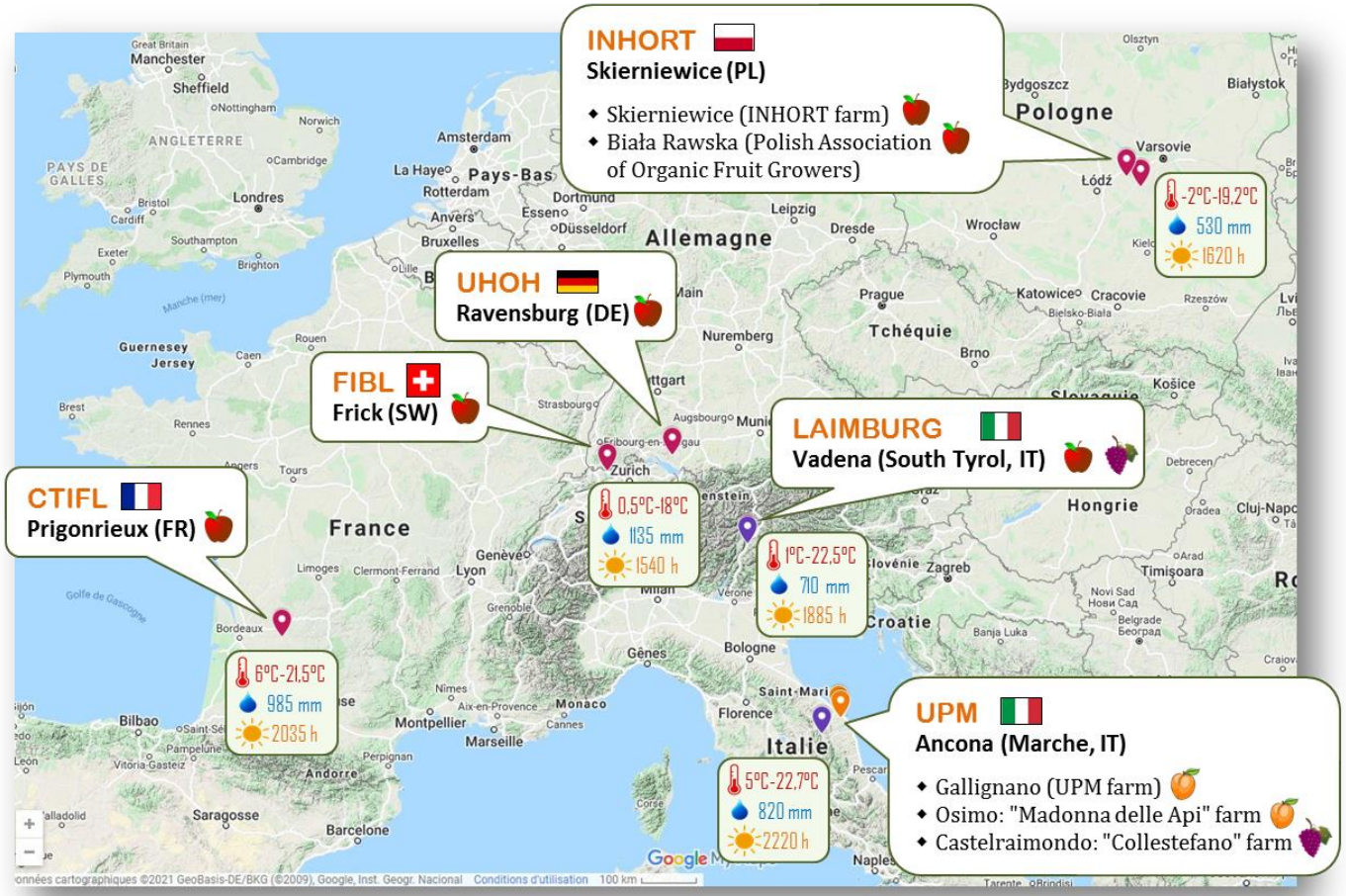
- Secondary crop
- Monetization of the system

Additional income for the farmer

Nutrients sources for the trees

DOMINO network: A wide range of climatic situations

- 6 countries involved
- 9 experimental sites
- 3 fruit crops
- Contrasted climatic areas: oceanic, continental and Mediterranean
- Various topographic situations: plain, low and high hills



44 herbaceous species tested as ground-covers on the tree-rows

- Seeded or planted as seedlings (manual)
- Purchased from nurseries or collected in local environment

44 herbaceous species tested as ground-covers on the tree-rows

Legume species

(dwarf cultivars)

44 herbaceous species tested as ground-covers on the tree-rows

Low growing species

44 herbaceous species tested as ground-covers on the tree-rows

Officinal crops

Potential cash crops

44 herbaceous species tested as ground-covers on the tree-rows

Edible crops

Potential cash crops

Using ground covers on the tree-rows: What learnings?

No "turnkey solution" identified

Great variability of adaptation of these herbaceous species to the ecosystem of the planted row

Using ground covers on the tree-rows: Species plasticity to local biotope

Adaptation to local biotope has to be verified on the rows of orchard or vineyard

UBIQUITOUS PLANTS

Mint species work well in a wide range of situations

Probably the same for Melissa

PLANTS WITH SPECIFIC REQUIREMENTS

- Some clover cultivars don't support water stress
- Strawberry species (wild or selected clones) require **very rainy situations** (especially in summer)

Comparison of mint development in the first year after planting in an open field or on tree rows (same location and soil)

Establishment on the tree-rows is very slower and much more heterogeneous than in the field

(French experiment in an apple orchard)

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Using ground covers on the tree-rows: advantage of local flora

Wild strawberries, native from the Sibillini Mountains, transplanted in a vineyard in Castelraimondo

The use of species collected from local spontaneous flora provides significant advantages

Potentilla already present in a Swiss orchard and transplanted on the tree-rows

Using ground covers on the tree-rows: advantage of local flora

Local *Gallium album* grown on the tree-rows of an apple orchard in South-Tyrol

The use of species collected from local spontaneous flora provides significant advantages

Potentilla already present in a Swiss orchard and transplanted on the tree-rows

Using ground covers on the tree-rows: weeding needed!

Complementary weeding measures
can be necessary to help the ground-cover species to establish *(during the 1st year? 2 years? more..?)*

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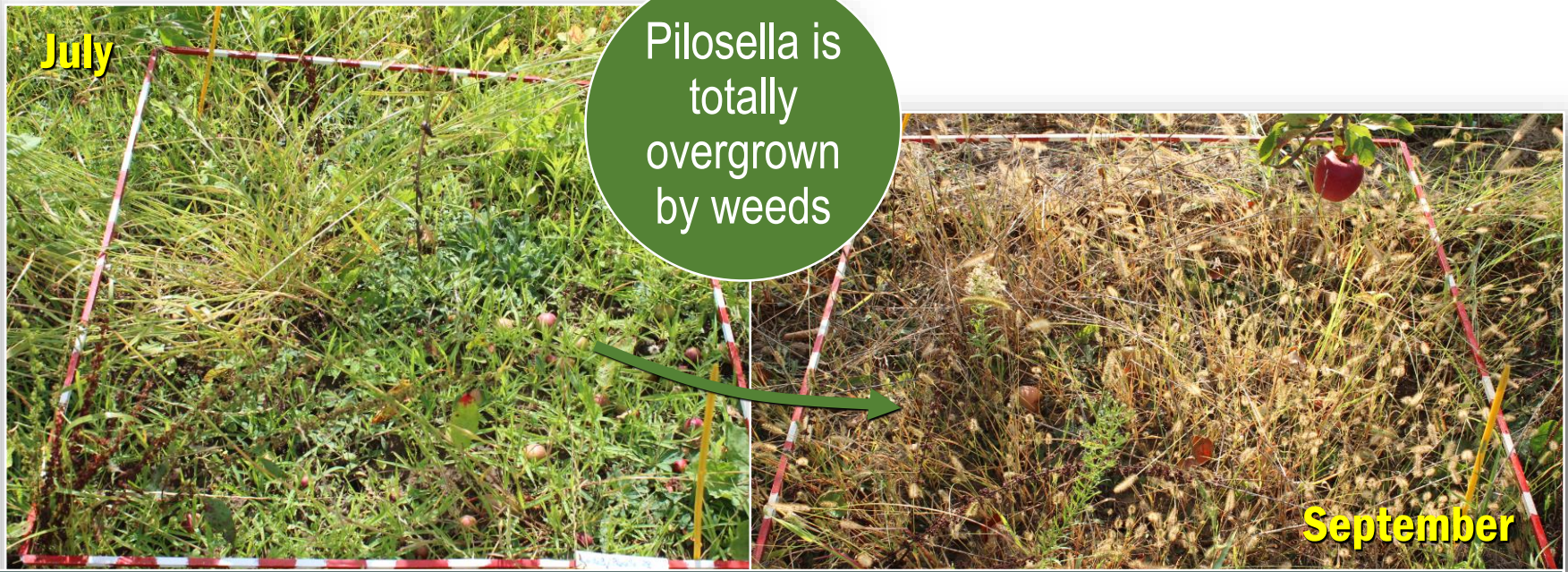
Hieracium aurantiacum planted on the rows of a Swiss apple orchard.
Manual weeding performed twice a year for 2 years

Using ground covers on the tree-rows: weeding needed!

Complementary weeding measures
can be necessary to help the ground-cover species to establish *(during the 1st year? 2 years? more..?)*



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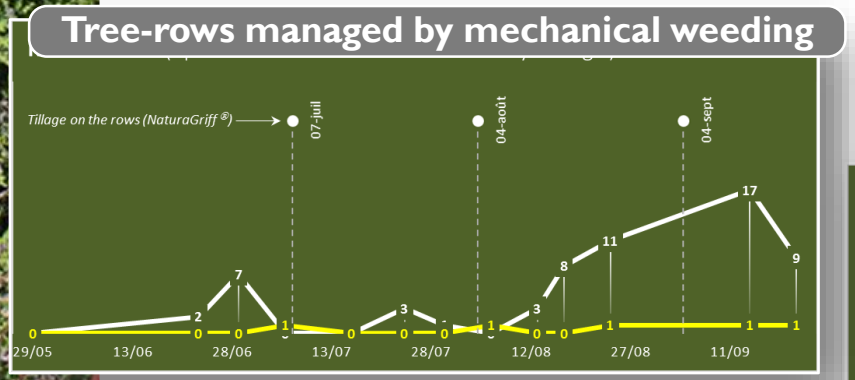
Hieracium plilosella planted at the same density in a French apple orchard.
Without any weeding measure.

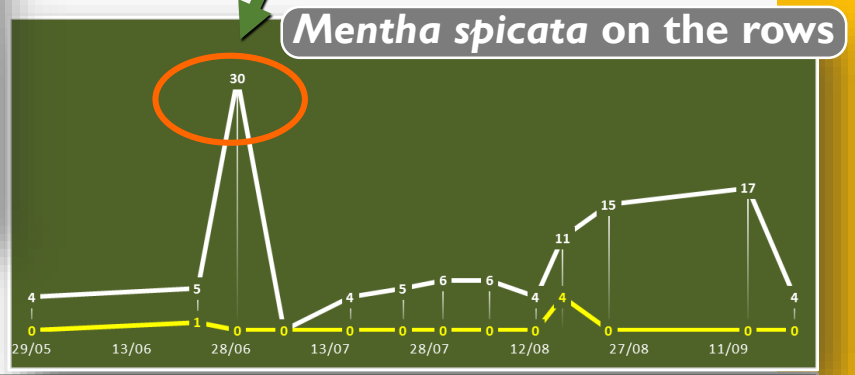
Using ground covers on the tree-rows: potential interests for pest control …

Some of these herbaceous species have positive impacts on antagonists of mite pests, aphids or nematodes



Total **ANTAGONIST** and **PEST** mites observed on 24 apple leaves

Peak in antagonist mites' populations in June



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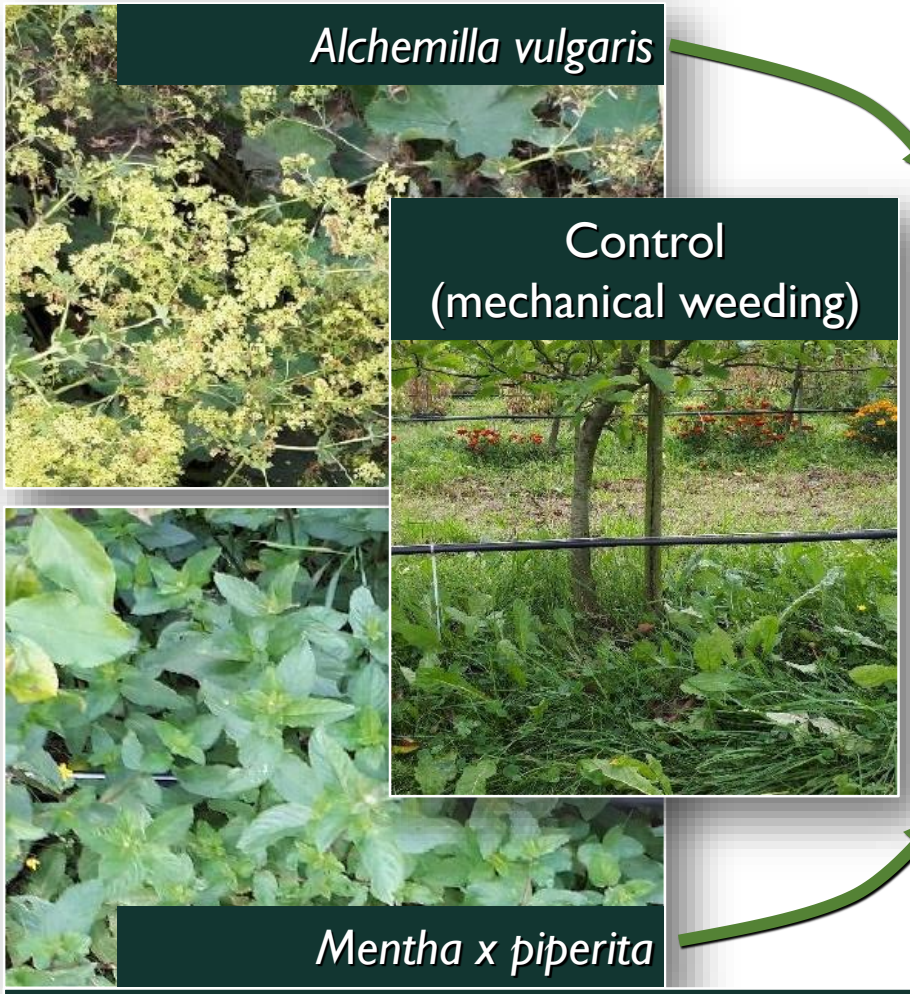
Significantly higher levels of antagonist mites are recorded on the leaves of apple trees, if mint is grown on the rows (in comparison to bare soil)

Using ground covers on the tree-rows: . . . and on soil nutrients uptakes

Belowground interactions between the root systems of the ground cover species and the trees can optimize soil nutrient uptakes



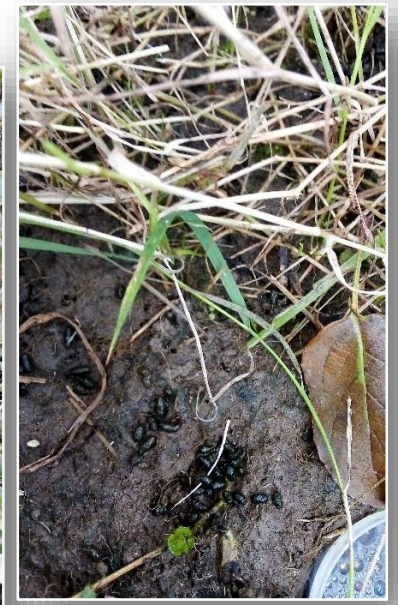
- Apple trees root dry weight densities: +30-40% with the ground covers
- Aboveground biomass of Alchemilla and Mint: +30% than the spontaneous flora on the weeded rows
- **BUT**: no difference in the nutrient contents of the apple leaves

INHORT

Using ground covers on the tree-rows: But only if it works!

Important yield losses if the ground covers don't succeed to compete with weeds

-20% yield compared to the control



And **damage to the trees** by rodents and deer

CTIFL

French apple orchard associated with ground covers on the tree-rows
6 months after their planting (mint, pilosella, micro-clover)

Using ground covers on the tree-rows: One important point: be careful to the costs!

Depending on labor costs, that also impacts plants prices, establishing ground cover species can be very expensive

3 x 2 (left/right) passages of a rotary hoe (1 km/h) to prepare the soil for planting

Marking of planting holes

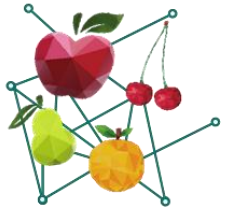
Planting the ground cover species

25'000 € per ha of orchard!

CTIFL

Planting operations and investment costs evaluation: example of the French experiment
For very poor results..!

Using ground covers on the tree-rows: Some recommendations



- Using ground cover species on the tree-rows is not an alternative to mechanical weeding in organic orchards
- **For fruit growers who would like to try this technique**: Start testing on very small areas, to verify *in situ* the adaptation of the chosen species to the very local conditions of the planting rows (which include climate, soil properties, water availability or excess, and weed seed stock), before considering extending the practice to larger areas

What about cash crops?

Additional income potential identified for: strawberries, officinal and aromatic species and pumpkin

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What about cash crops ?

Cucurbita pepo grown as an annual crop on the rows of a Polish apple orchard.

Additional income potential identified for: strawberries, officinal and aromatic species and pumpkin

What about cash crops? Interests

Mentha x piperita grown along the rows of a German apple orchard.

- Using species already cultivated on a relatively large-scale may be a good option to find organic plants at lower prices
- In suitable conditions, they could give a significant production each year

What about cash crops? Two important conditions

Mentha x piperita grown along the rows of a German apple orchard.

- Verify their adaptation to local conditions of the tree-rows

👉 **No pesticide spray (even organic) in the orchard**

What about cash crops? Suggestions

- A possible good option in case of direct farm sales, or self-harvest on farm by customers
- An added value in terms of costumer's perception, retention and publicity
- …even if done just on small areas of the farm…

Brochure

Brochure with lessons learned and recommendations for fruit growers:

THANKS FOR YOUR ATTENTION!

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