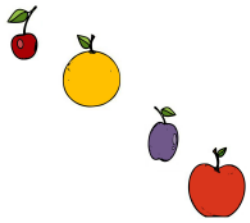
# **ALTO**, orchard redesign towards agroecology to produce without any pesticides

UERI Gotheron, UR PSH,
UR Ecodéveloppement
UMR SYSTEM, UR EMMAH Sols

## Context

- **Sustainability** of current orchards is questioned
- Strongly **reducing pesticide use** in current orchards induces **risk of fruit damage** (BioREco[1], EcoPêche[2] and CAP-ReD[3] projects)
- Is **plant diversification** a way to reduce pesticide use?



## Aims

- To **rethink the agroecosystem** to produce fruit in very low pesticide or pesticide-free systems & to build **concrete proposals** for tomorrow
- To **assess** the effect of plant diversification in the agroecosystem on the orchard sustainability and ecosystem services
- To **share** the approach and knowledge with stakeholders

## An agroecological approach

### A partnership-based dynamic

Visits

Co-design workshops

Agro Café

Interdisciplinary actions

**Agro Café « Les brebis en verger » (*Sheeps into the orchards*), Gotheron 2019**

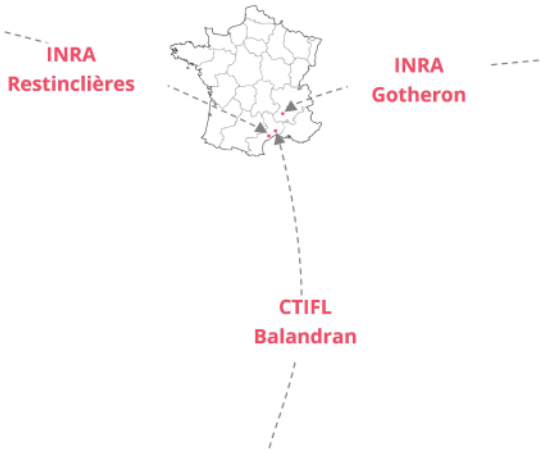
**Workshop for co-design of the Unit 1, Balandran 2018**

### 3 experimental sites

**Resources sharing through time and space**

Apple trees under walnuts, Restinclières in 2018

- Apple (planting year 2016), walnut and leguminous cover plants associated in agroforestry systems
- Organic farming




**Orchard re-design from the ground up**

Unit 1, Gotheron in 2018

- Fruit species and cultivars alternated within and between 'rows': apple (planting year 2018), plum, peach, apricot, fig, pomegranate, nut fruits, soft fruits...
- Companion plants and habitats to foster biodiversity at landscape scale
- Organic farming excluding all pesticides (even biocontrol)

**Step by step redesign in a highly diversified environment**

- Alternated fruit tree rows: apple (planting year 2019), olive, apricot, kiwi fruit, persimmon, plum, fig and citruses...
- Habitats and infrastructures to foster biodiversity: hedgerows, ponds, shelters, nest-boxes... at landscape scale.
- Organic farming excluding pesticides but biocontrol solutions and low dose copper applications

Unit 1, Balandran in 2019

# Focus - Gotheron site

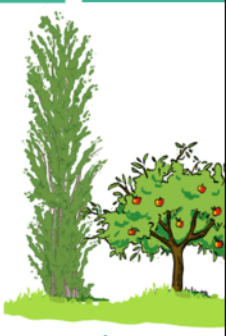
## Experimental system « Unit 1 » in Gotheron

### Spatial layout, mix cropping and multilayer design

**Compared to its surface, the circle is the shape with the smallest outer edge with the surrounding landscape, a potential source of pests and diseases. The layout of the experimental plot has been designed to re-inforce multiple services, through a diversity of plant layers, species and cultivars.**

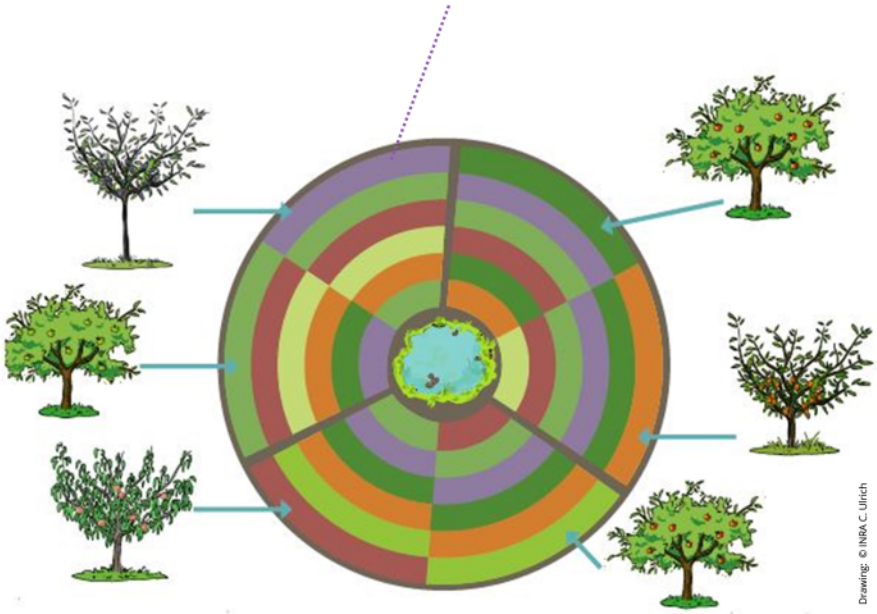






### 4 Cultivar diversity, cultural control, commercialisation

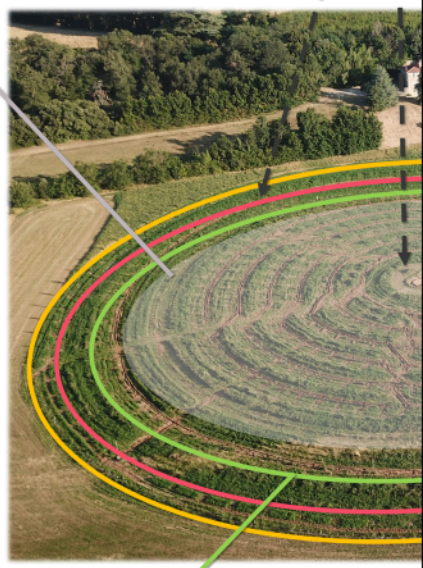
> To produce pome and stone fruits
> To diversify species and cultivars to limit pests and diseases
> Low-susceptible cultivars
> Legumes cover crops to promote soil fertility
> Same number of trees for each stone fruit species and cultivar, for sales purpose
> Traffic optimization along the 6 fruit spirals

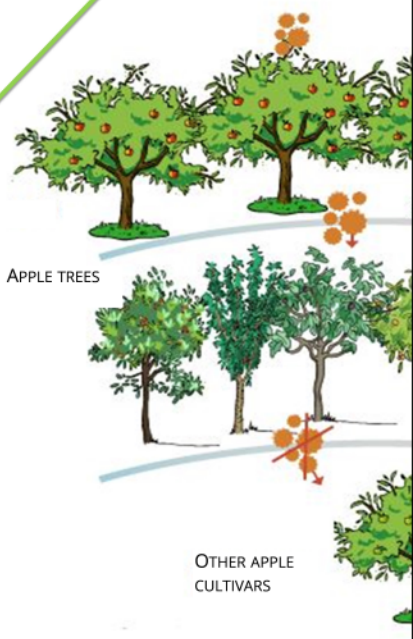



- Apricot ( arieties: Malice, Vertige)
- Plum (Reine Claude Bavay, Reine Claude Dorée)
- Peach (Bénédicte, Maria Bianca)
- Apple duo 1 (Honey crisp, Reine des reinettes)
- Apple duo 2 (Ecollette, Reinette des capucin)
- Apple duo 3 (Garance, Juliet)

### Conservation biological control

Habitats, food resources and breeding habita
predators or parasitoids of the fruit tree pests

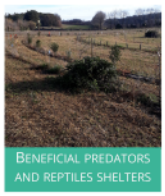





### 3 Plant barrier and production diversification

The « müesli » circle is an additional barrier between outer apple trees and inner fruit trees production circles. It produces diversified fruits, aims at limiting the pest and disease spread and providing resources to natural enemies.

FLOWER STRIP : POLLEN, NECTAR



BENEFICIAL PREDATORS AND REPTILES SHELTERS

Drawing: © INRA C. Ulrich

ts for the natural enemie, i.e.

## 1 Plant barrier and conservation biological control

The outer circle of the plot aims to limit the wind, promote biodiversity and produce nuts. It includes large and indigenous forest species, shrubs hosting a diversity of natural enemies, and also almonds and chestnuts trees.

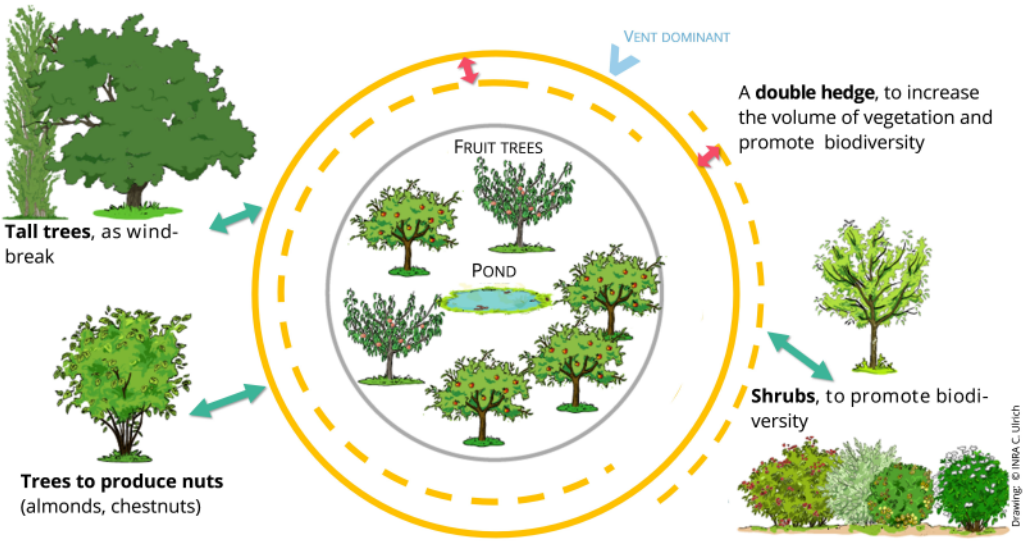
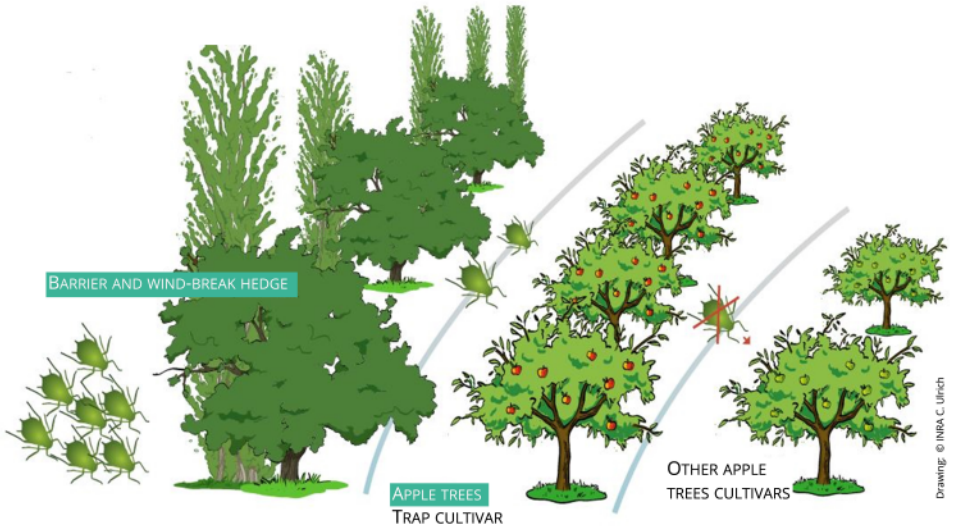
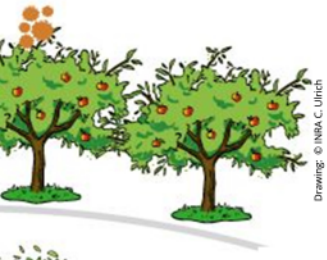



Photo credit : T. Nicolas

## 2 Trap plants and plant barrier

Aphids crossing the outer circle are attracted by the adjacent apple cultivar. This low-susceptibility cultivar limits aphid development with no fruit damage due to infestation. It acts as a trap cultivar pulling aphids in this circle and protecting other inner apple cultivars.



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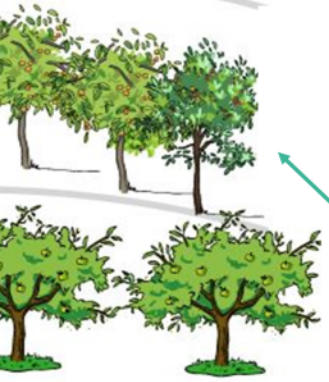
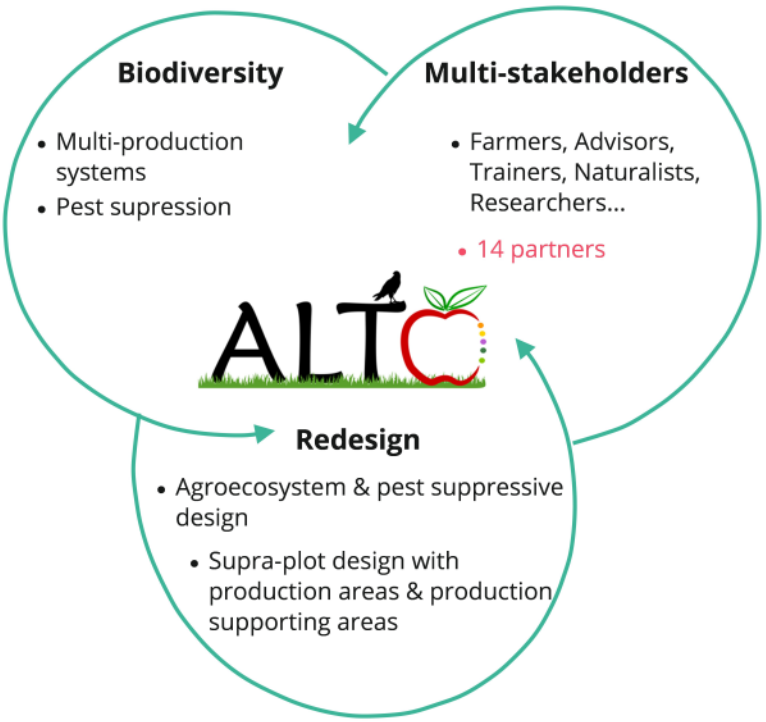


« MÜESLI » CIRCLE

- **Barrier**: to limit the spread of pest and diseases from one circle to another
- **Production**: a diversity of fruit trees and berries: fig, hazelnut, pomegrenate, persimmon, raspberry,
- **Biodiversity**: corridors with shrubs for natural enemies: *Viburnum tinus*, hazelnut, *Arbutus*....

## ALTO, an interdisciplinary approach




## Expected results

> **Co-design methodology**
to design more or less breaking systems

> **Knowledge about biological processes:**
pest suppression, fruit tree behaviour in multi-crop systems

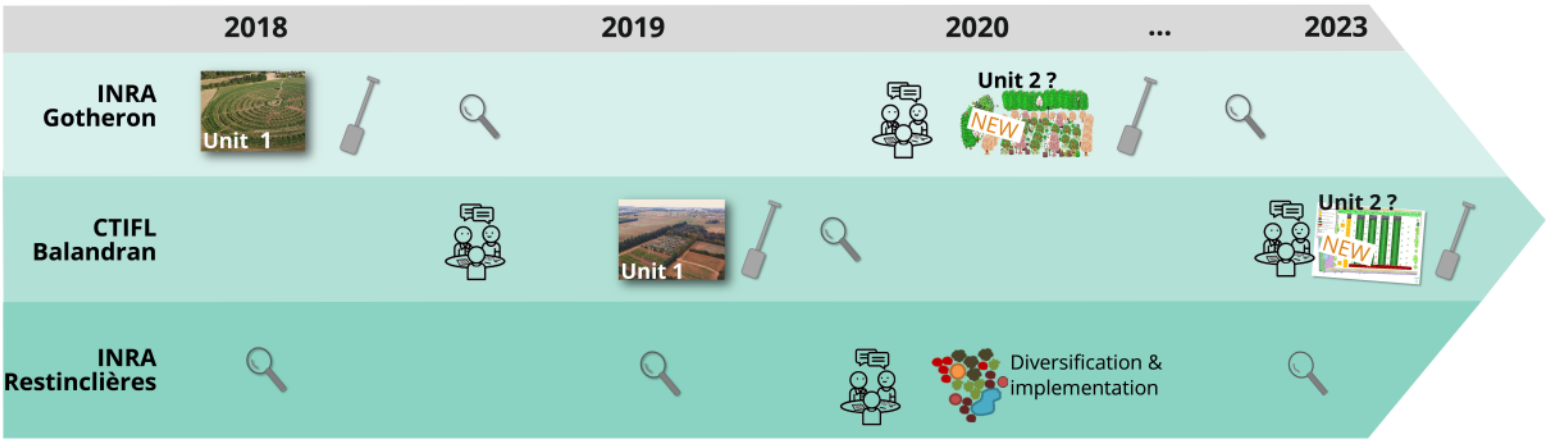
> **Prototypes**
of very low-input orchards

> **Multi-criteria assessment**
of multi-production complex systems

> **New types of interactions**
between stakeholders

## An on-going project...

Planting | Co-design activities | Biodiversity surveys, multi-criteria assessments




## Multiple partners, skills and expertises

Agri Bio Ardèche

Agribiodrôme

GRCETA de Basse Durance - Conseil technique en arboriculture fruitière

Centre technique interprofessionnel des fruits et légumes

Groupe de recherche en agriculture biologique

Institut technique interprofessionnel des plantes à parfum, aromatiques et médicinales

EPLEFPA Le Valentin

Ligue pour la Protection des Oiseaux - Auvergne Rhône Alpes

Chambre d'agriculture de la Drôme

UERI Gotheron, UMR System, UR Ecodéveloppement, UR PSH, UMR EMMAH Sols

### For further information

[1]https://www6.inra.fr/experimentations-systeme/Les-experimentations/Arboriculture/BioReco
[2]https://www6.paca.inra.fr/psh/Contrats-et-Projets/EXPE-DEPHY-Ecophyto-EcoPeche
[3]https://www6.paca.inra.fr/ueri/Contrats-et-projets/Expe-DEPHY-Ecophyto-CAP-ReD
https://www6.paca.inra.fr/ueri/Contrats-et-projets/Expe-DEPHY-Ecophyto-II-ALTO

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