



Deliverable n. 2.2

**DYNAMIC SOD MULCHING AND USE OF RECYCLED AMENDMENTS TO INCREASE BIODIVERSITY, RESILIENCE AND SUSTAINABILITY OF INTENSIVE ORGANIC FRUIT ORCHARDS AND VINEYARDS**

**TRIALS DESCRIPTION**



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# INTRODUCTION OF NEW CASH INTERCROPPING SPECIES, EXPECTED TO CONTRIBUTE TO PLANT NUTRITION AND PROTECTION WHILE INCREASING BIODIVERSITY



## 1.1 ON-ORCHARD LIVING MULCHES TRIAL

<b>Research Institute</b>	<b>CTIFL</b>
<b>Organism hosting the trial</b>	CTIFL, Center of Lanxade <i>(private &amp; public funds)</i> <span style="float: right;"><i>Private</i></span>
<b>Trial location</b>	Prignonrieux (24, France) ( 44° 51' 18" N 0° 24' 15" E)
<b>Total core-plot area</b>	2300 m <sup>2</sup>
<b>Perennial crop species</b>	Apple
<b>Research topic</b>	<b>Overall objective:</b> Improving biodiversity in an apple organic production system through the installation of living mulches <b>Specific objective of the trial:</b> Assessment, on an apple orchard and with a small selection of ground cover species, of the relevance of planting living mulches to maintain or increase agronomic, environmental and economic overall performance of a new production system
<b>Experimental factor(s)</b>	Cross-effect of two factors: 1) Cover-crop species or species mix established on the tree rows 2) Cover-crop species or species-mix established on orchard's interrows
<b>Experimental variants</b>	<i>Living mulch species 1</i> <i>Living mulch species 2</i> <i>Living mulch species 3</i> <i>Grren manure species mixture 1</i> <i>Grren manure species mixture 2</i> <i>Grren manure species mixture 3</i>
<b>Experimental control(s)</b>	"Grassed inter-row mantained by mowing" x "Mechanically weeded row"
<b>N. of blocks</b>	4
<b>Number of trees per elementary area</b>	10 trees
<b>Total number of trees per treatment</b>	40 trees
<b>Starting time</b>	September 2019

<p><b>Parameters monitored</b></p>	<p>Soil cover percentage</p> <p>Earthworm abundance</p> <p>Mesofauna abundance</p> <p>Soil infiltration capacity</p> <p>Relative soil moisture</p> <p>Soil nutrient parameters (granulometry, SOM, CEC, P, K, Mg, Ca, Mn)</p> <p>Nitrogen balance</p> <p>Pests and beneficials abundance on trees</p> <p>Key stages of the living mulches growing cycle</p> <p>Key stages of the apple growing cycle and dates of technical operations in the orchard</p> <p>Trunk diameters of trees</p> <p>Floridity of trees</p>
	<p>Apple yield per tree</p> <p>Pest damages on apple production</p> <p>Fruit size, coloring, firmness, starch level, malic acidity on apple production</p> <p>Living mulches production (yield)</p> <p>Working time and input costs</p>







<b>Research Institute</b>	INHORT
<b>Organism hosting the trial</b>	INHORT Public
<b>Trial location</b>	Skierniewice (PL) ( 51.9547° N, 20.1583° E)
<b>Total core-plot area</b>	3500 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	living mulches specie 1 - <i>Salvia hispanica</i>
	living mulches specie 2 - <i>Taraxacum officinale</i>
	living mulches specie 3 - <i>Nasturtium sp.</i>
	living mulches specie 4 - <i>Mentha sp.</i>
	living mulches specie 5 - <i>Melissa officinalis</i>
	living mulches specie 6 - Mix of <i>Tagetes sp.</i> , <i>Calendula sp.</i> , <i>Petroselinum sp.</i>
<b>Experimental control</b>	No living mulches
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	6
<b>N. plant per treatment</b>	24
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	living mulches growth Soil cover percentage Beneficial mites on apple trees





<b>Partner hosting the trial</b>	INHORT Public
<b>Trial location</b>	Skierniewice - Podlesna (PL) ( 51.9547° N, 20.1583° E)
<b>Total core-plot area</b>	3500 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	cover crop 1
	cover crop 2
	cover crop 3
	cover crop 4
	cover crop 5
	cover crop 6
	cover crop 7
	cover crop 8
<b>Experimental control</b>	natural cover
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	mar-19
<b>Parameters monitored</b>	cover crop growth
	soil cover percentage
	cover crop yield
	tree growth
	tree yield
	Soil biodiversity (nematodes)
	Above ground biodiversity (arthropods)
Effect on pathogens and pests incidence	

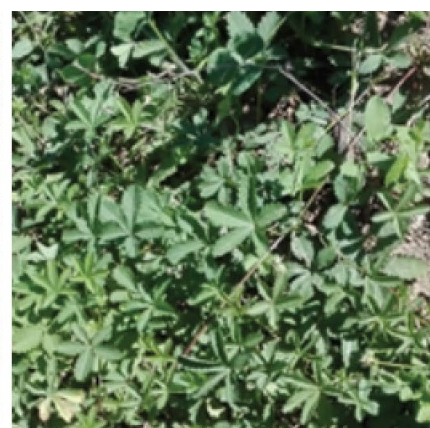
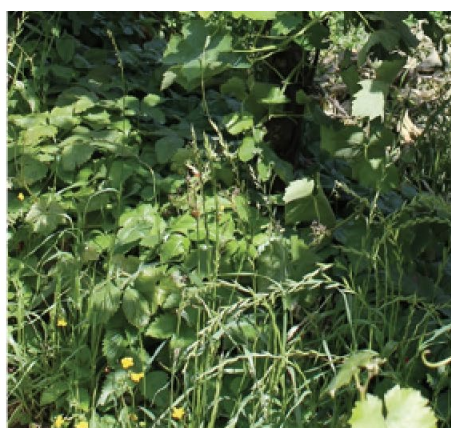


<b>Research Institute</b>	INHORT
<b>Company hosting the trial</b>	Polish Association of Organic Fruit Producers Private
<b>Trial location</b>	Biała Rawska (PL) ( 51.8077° N, 20.4725° E)
<b>Total core-plot area</b>	5000 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Inter-row management to increase N availability
<b>Experimental variant</b>	Festuca ovina + micro clover
<b>Experimental control</b>	Festuca ovina + white clover natural cover
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	20
<b>N. plant per treatment</b>	80
<b>Starting time</b>	mar-19
	soil cover percentage tree growth tree yield

<b>Research Institute</b>	INHORT
<b>Company hosting the trial</b>	Polish Association of Organic Fruit Producers Private
<b>Trial location</b>	Biała Rawska (PL) ( 51.8077° N, 20.4725° E)
<b>Total core-plot area</b>	5000 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	living mulches species 1 living mulches species 2 living mulches species 3 living mulches species 4
<b>Experimental control</b>	natural cover
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	20
<b>N. plant per treatment</b>	80
<b>Starting time</b>	mar-19
	soil cover percentage cover species yield



<b>Research Institute</b>	UNIVPM
<b>Organism hosting the trial</b>	UNIVPM <span style="float: right;">Public</span>
<b>Trial location</b>	Gallignano (AN) ( 13° 25' 30" N 43° 33' 46" E)
<b>Total core-plot area</b>	5000 m <sup>2</sup>
<b>Crop species</b>	Apricot
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	living mulches with wild strawberry
	living mulches with white strawberry octoploid
	living mulches with pink strawberry diploid
	living mulches <i>Potentilla reptans</i>
<b>Experimental control</b>	No living mulches
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	4
<b>N. plant per treatment</b>	16
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Apricot canopy growth (trunk diameter, physiological status index, plant eight)
	Apricot root growth (root density)
	Apricot physiological activity (SPAD index, CO <sub>2</sub> exchange rate)
	Soil cover percentage
	Soil CO <sub>2</sub> exchange rate
	living mulches development (soil cover %, physiological status index)
	living mulches production (yield)







<b>Research Institute</b>	UNIVPM
<b>Organism hosting the trial</b>	Farm "Madonna delle Api" Private
<b>Trial location</b>	Osimo (AN) (43°29'45"N 13°32'44"E )
<b>Total core-plot area</b>	3000 m <sup>2</sup>
<b>Crop species</b>	Apricot
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	living mulches with wild strawberry
	living mulches with wild strawberry at double density
	living mulches with white strawberry octoploid
<b>Experimental control</b>	No living mulches
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	4
<b>N. plant per treatment</b>	12
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Soil cover percentage
	Soil CO <sub>2</sub> exchange rate
	living mulches development (soil cover %, physiological status index)
	living mulches production (yield)







<b>Research Institute</b>	UNIVPM
<b>Organism hosting the trial</b>	Farm "Collestefano" Private
<b>Trial location</b>	Castelraimondo (MC) (43°12'32.76"N 13°03'16.56"E )
<b>Total core-plot area</b>	3000 m <sup>2</sup>
<b>Crop species</b>	Grape
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	living mulches with wild strawberry
	living mulches with wild strawberry at double density
<b>Experimental control</b>	No living mulches
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	4
<b>N. plant per treatment</b>	12
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Soil cover percentage
	Soil CO <sub>2</sub> exchange rate
	living mulches development (soil cover %, physiological status index)
	living mulches production (yield)





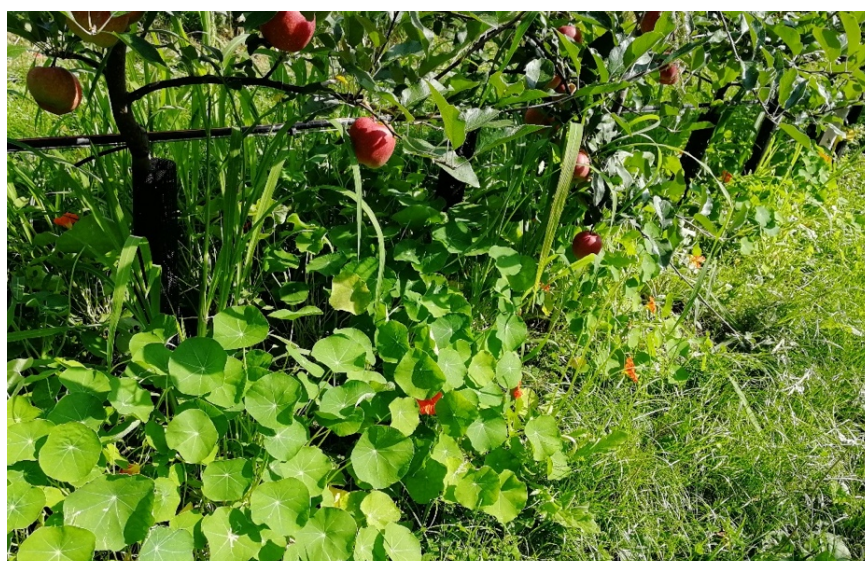
<b>Research Institute</b>	UNIVPM
<b>Organism hosting the trial</b>	UNIVPM <span style="float: right;">Public</span>
<b>Trial location</b>	Gallignano (AN) ( 13° 25' 30" N 43° 33' 46" E)
<b>Total core-plot area</b>	5000 m <sup>2</sup>
<b>Crop species</b>	Apricot
<b>Research topic</b>	Effectiveness of manual weeding on weeds control and weed population
<b>Experimental variant</b>	Manual weeding
<b>Experimental control</b>	No weeding
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Apricot canopy growth (trunk diameter, physiological status index, plant eight)
	Apricot physiological activity (SPAD index, CO <sub>2</sub> exchange rate)
	Apricot root growth (root density)
	Phytosociological analysis
	Soil cover percentage
	Soil CO <sub>2</sub> exchange rate







<b>Research Institute</b>	LAIM
<b>Organism hosting the trial</b>	LAIM
<b>Trial location</b>	Vadena (BZ) (46°23'16.0"N 11°17'21.3"E)
<b>Total core-plot area</b>	1650 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	<i>Portulaca oleracea</i>
	<i>Tropaeolum majus</i>
	<i>Potentilla reptans</i>
	<i>Galium mollugo</i>
	<i>Fragaria Vesca</i>
	<i>Trifolium resupinatum</i> var. <i>resupinatum</i>
	<i>Achillea millefolium</i>
	<i>Trifolium repens</i>
<b>Experimental control</b>	No living mulches
	No living mulches + soil tillage
<b>N. of blocks</b>	8 + 2
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	Fall 2018 and Spring 2019
<b>Parameters monitored</b>	trunk diameter
	Soil analyses (tot-N, tot-C, org-C, nutrients, pH, humus)
	N min
	Leaf analyses (macro and micro nutrients)
	Living mulches soil cover percentage (Braun Blanquet index)
	Living mulches development (nr. of stolons)
	Living mulches biomass





<b>Research Institute</b>	LAIM
<b>Organism hosting the trial</b>	LAIM
<b>Trial location</b>	Vadena (BZ) (46°21'44.0"N 11°17'19.2"E)
<b>Total core-plot area</b>	380 m <sup>2</sup>
<b>Crop species</b>	Grapes
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control.
<b>Experimental variant</b>	Portulaca oleracea Galium mollugo Euphorbia helioscopia Sanguisorba minor Potentilla reptans Glechoma hederacea Fragaria Vesca Salvia pratensis Achillea millefolium
<b>Experimental control</b>	No living mulches + soil tillage No living mulches
<b>N. of blocks</b>	9 + 2
<b>N. of plant per treatment per block</b>	5
<b>N. plant per treatment</b>	20
<b>Starting time</b>	Fall 2018 and Spring 2019
<b>Parameters monitored</b>	Trunk diameter Soil analyses (tot-N, tot-C, org-C, nutrients, pH, humus) N min Leaf analyses (macro- and micro- nutrients) Living mulches soil cover percentage (Braun Blanquet index) Living mulches development (nr. of stolons) Living mulches biomass







<b>Research Institute</b>	UHOH
<b>Organism hosting the trial</b>	Kompetenzzentrum Obstbau Bodensee Public
<b>Trial location</b>	Ravensburg (47°46'26.3"N 9°31'41.2"E)
<b>Total core-plot area</b>	120 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Establishment of potential secondary cash crops in the tree row
<b>Experimental variant</b>	secondary cash crop 1 (wild strawberry) secondary cash crop 2 (pepper mint)
<b>Experimental control</b>	No secondary cash crop, hoed No secondary cash crop, untreated
<b>N. of blocks</b>	Demonstration trial, no repetition
<b>N. of plant per treatment per block</b>	3
<b>N. plant per treatment</b>	3
<b>Starting time</b>	ott-18
<b>Parameters monitored</b>	Soil cover percentage (crops) Soil cover percentage (weeds), weed species







<b>TRIAL WP 3.1 Trials with comparison of different crops for row management suitable for additional uses</b>	
<b>Research Institute</b>	FiBL
<b>Organism hosting the trial</b>	FiBL <span style="float: right;">Private</span> <i>(Public or private)</i>
<b>Trial location</b>	Frick (Switzerland) (47°30'57.6"N 8°01'28.5"E)
<b>Total core-plot area</b>	320 m <sup>2</sup>
<b>Crop species</b>	Apple (Variety "Ariane")
<b>Research topic</b>	Effectiveness of living mulches species in soil cover and weeds control
<b>Experimental variant</b>	Fragaria vesca
	Mentha sp.
	max. 5 further plant species (species to be defined)
<b>Experimental control</b>	no control because only demonstration plots
<b>N. of blocks</b>	1 (no repetition; demonstration plot)
<b>N. of plant per treatment per block</b>	around 10 m per plant species
<b>N. plant per treatment</b>	around 10 m per plant species
<b>Starting time</b>	spring 2019
<b>Parameters monitored</b>	ground cover (crops)
	ground cover (weeds)

## THE USE OF RECYCLED ORGANIC AMENDMENTS FROM COMPOSTED WASTE AND DIGESTATE TO IMPROVE SOIL FERTILITY AND SUPPRESSIVENESS, AS WELL AS CARBON BALANCE OF THE SYSTEM



<b>Research Institute</b>	INHORT
<b>Organism hosting the trial</b>	INHORT Public
<b>Trial location</b>	Dąbrowice (PL) ( 51.9216° N, 20.0977° E)
<b>Total core-plot area</b>	2000 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	New local organic fertilizers
<b>Experimental variant</b>	Dry animal manure
	Yeast stillage
	Liquid digestate
	Keratin
	Pellet of clover
<b>Experimental control</b>	Unfertilized
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	20
<b>N. plant per treatment</b>	80
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Yield Tree growth Soil biodiversity (fungi, bacteria and nematodes) Above ground biodiversity (arthropods)





<b>Research Institute</b>	UHOH Public (Public or private)
<b>Organism hosting the trial</b>	Kompetenzzentrum Obstbau Bodensee Public
<b>Trial location</b>	Ravensburg (47°46'41.9"N 9°31'52.0"E)
<b>Total core-plot area</b>	2100 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effect of different fertilisers on nutrient budget and nutrient supply, tree growth, yield and fruit quality
<b>Target N fertilization</b>	25 kg/ha with 2857 trees/ha
<b>Experimental variant</b>	Fertiliser 1 (spring peas) Fertiliser 2 (winter peas long: are incorporated like the other fertilizers) Fertiliser 3 (winter peas short: are incorporated when spring peas are sown) Fertiliser 4 (vinasse) Fertiliser 5 (biogas digestates) Fertiliser 6 (compost) Fertiliser 7 (horn grit) Fertiliser 8 (clover grass pellets) Fertiliser 9 (clover grass silage) Fertiliser 10 (compost farmers)
<b>Experimental control</b>	No fertilisation

<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	mar-18
<b>Parameters monitored</b>	Apple tree growth (trunk diameter, shoot growth)
	Leaves (nutrient content)
	Fruit (yield, sugar, acid, firmness, colour, size, nutrient content)
	Soil (Macro-/ Micronutrients)
	Fertilisers (nutrient content)
	Soil Nmin, Smin content







<b>Research Institute</b>	UHOH
<b>Organism hosting the trial</b>	UHOH <span style="float: right;">Public</span>
<b>Trial location</b>	Hohenheim (S) (48°42'44.7"N 9°12'31.1"E)
<b>Total core-plot area</b>	Pot trial in greenhouse
<b>Crop species</b>	ryegrass
<b>Research topic</b>	Effect of sulphur application on soil properties
<b>Experimental variant</b>	soil 1 (South Germany, high Cu load, high S input)
	soil 2 (South Germany, high Cu load, no S input)
	soil 3 (South Germany, no Cu, no S input)
	soil 4 (North Germany, high Cu load, high S input)
	soil 5 (North Germany, no Cu, no S input)
<b>Experimental factor</b>	3 sulphur application rates
<b>N. of blocks</b>	5
<b>N. of blocks with plants per treatment</b>	4
<b>Starting time</b>	planned for 01.05.2019
<b>Parameters monitored</b>	<b>soil</b>
	C, N, S, P, Cu, Zn
	CaCO <sub>3</sub> , CEC, pH, buffering capacity
	texture
	Ca, Mg, Cu, Zn, S, N in eluate
	Nmin, Smin
	<b>plant</b>
	Ca, Mg, K, P, Na
	C, N, S, P, Cu, Zn





<b>Trial location</b>	Vadena (BZ) (46°22'52.7"N 11°17'26.6"E)
<b>Total core-plot area</b>	2100 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of the system “keep in touch” on pest and fungal control.
<b>Experimental variant</b>	Keep in touch system
<b>Experimental control</b>	Without Keep in touch system and without plant protection products treatments Without Keep in touch system and with (organic) plant protection products treatments
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	Spring 2019
<b>Parameters monitored</b>	fruit quality fungal infections on leaves fungal and pest damages on fruits during the harvest and after the storage





<b>Trial location</b>	Vadena (BZ) (46°22'58.9"N 11°17'25.1"E)
<b>Total core-plot area</b>	2100 m <sup>2</sup>
<b>Crop species</b>	Apricot
<b>Research topic</b>	Effectiveness of the system “keep in touch” on pest and fungal control.
<b>Experimental variant</b>	Keep in touch system
<b>Experimental control</b>	Without Keep in touch system and without plant protection products treatments
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	Spring 2018
<b>Parameters monitored</b>	fungal infections on leaves
	fungal and pest damages on fruits during the harvest and after the storage



<b>Research Institute</b>	FiBL
<b>Organism hosting the trial</b>	FiBL <span style="float: right;">Private</span>
<b>Trial location</b>	Frick (Switzerland) (47°30'57.6"N 8°01'28.5"E)
<b>Total core-plot area</b>	640 m <sup>2</sup>
<b>Crop species</b>	Apple (Varities "Topaz" and "Ariwa")
<b>Research topic</b>	testing the effect of a weather protection on the apple production regarding disease and pest damages
<b>Experimental variant</b>	weather protection and no plant protection no weather protection and no plant protection
<b>Experimental control</b>	no weather protection and standard organic plant protection
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	9
<b>N. plant per treatment</b>	27
<b>Starting time</b>	spring 2019
<b>Parameters monitored</b>	assessment of diseases and pests fruit quality (including storability)



## 5.1 GROUND COVERS ASSESSMENT TRIAL

<b>Research Institute</b>	<b>CTIFL</b>
<b>Organism hosting the trial</b>	CTIFL, Center of Lanxade <span style="float: right;"><i>Private</i></span> (private & public funds)
<b>Trial location</b>	Prignonrieux (24, France) ( 44° 51' 18" N 0° 24' 15" E)
<b>Total core-plot area</b>	4750 m <sup>2</sup>
<b>Perennial crop species</b>	Apple
<b>Research topic</b>	<b>Overall objective:</b> Improving biodiversity in an apple organic production system through the installation of living mulches <b>Specific objective of the trial:</b> Pre-screening of living mulch species for further use on the rows and/or the inter-rows in an organic apple orchard. Evaluation of (i) ground covers ecosystemic services, (ii) their capacity to adapt to local pedoclimatic conditions, (iii) their compatibility with apple management practices
<b>Experimental factor(s)</b>	Cover-crop species or species mix
<b>Experimental variants</b>	<i>Mentha spicata</i> <i>Sagina subulata</i> <i>Soleirolia soleirolii</i> <i>Scleranthus biflorus</i> <i>Fragaria vesca</i> <i>Tagetes species</i> <i>Hieracium pilosella</i> <i>Melissa officinalis</i> <i>Thymus hirsutus</i> <i>Potentilla verna</i> White micro-dwarf clover (Barenbrüg's cultivar) Dwarf alfalfa (Barenbrüg's cultivar) <i>Trifolium fragiferum</i> (Barenbrüg's cultivar) Oats / Vetch / Alexandrian clover (« Green Spirit Proteo 2 » - BARENBRUG) White clover/Trefoil/Brdsfoot trefoil (« Multiflore LD » - BARENBRUG) Oats / Fababeans Lupin / Forage peas / Vetch Chia Mixture of 25 field flowers (Mixture « Coccinelle » from BARENBRUG)

<b>Experimental control(s)</b>	REF1 : English Ray Grass / Tall fescue (« Enherbement verger N°3 » - BARENBRUG)
	REF2 : Bare soil naturally reseeded
<b>N. of blocks</b>	3
<b>Elementary plots area</b>	250 m <sup>2</sup>
<b>Total area per treatment</b>	750 m <sup>2</sup>
<b>Starting time</b>	Fall 2018
<b>Parameters monitored</b>	<p>Soil cover percentage</p> <p>Earthworm abundance</p> <p>Mesofauna abundance</p> <p>Soil infiltration capacity</p> <p>Relative soil moisture</p> <p>Soil nutrient parameters (granulometry, SOM, CEC, P, K, Mg, Ca, Mn)</p> <p>Nitrogen balance</p> <p>Pests and beneficials abundance</p> <p>Key stages of the living mulches growing cycle</p> <p>Key stages of the apple growing cycle and dates of technical operations in the orchard</p> <p>Living mulches production (yield)</p> <p>Working time and input costs</p>







<b>Research Institute</b>	INHORT
<b>Organism hosting the trial</b>	INHORT Public
<b>Trial location</b>	Skierniewice (PL) ( 51.9547° N, 20.1583° E)
<b>Total core-plot area</b>	3500 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	3.2 Interrow for nutritional management
<b>Experimental variant</b>	Lupin
<b>Experimental control</b>	Natural cover
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	30
<b>Starting time</b>	giu-18
<b>Parameters monitored</b>	Soil cover percentage





<b>Partner hosting the trial</b>	INHORT Public
<b>Trial location</b>	Skierniewice - Podlesna (PL) ( 51.9547° N, 20.1583° E)
<b>Total core-plot area</b>	3500 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Inter-row management to increase N availability
<b>Experimental variant</b>	Festuca ovina + Kura clover
	Festuca ovina + white clover
	Festuca ovina + Galega orientalis
	Microclover
<b>Experimental control</b>	natural cover
<b>N. of blocks</b>	4
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	mar-19
<b>Parameters monitored</b>	cover crop growth soil cover percentage soil nutrients availability tree growth tree yield



<b>Research Institute</b>	LAIM
<b>Organism hosting the trial</b>	LAIM
<b>Trial location</b>	Vadena (BZ) (46°23'16.0"N 11°17'21.3"E)
<b>Total core-plot area</b>	3200 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Effectiveness of green manure species on soil fertility
<b>Experimental variant</b>	<i>Trifolium incarnatum</i>
	<i>Pisum sativum</i>
	<i>Secale cereale</i>
	<i>Canapa sativa</i>
	<i>Raphanus sativus var. Oleiformis</i>
<b>Experimental control</b>	No green manure
<b>N. of blocks</b>	5 + 1
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	40
<b>Starting time</b>	Fall 2018 and Spring 2019
<b>Parameters monitored</b>	trunk diameter
	Soil analyses (tot-N, tot-C, org-C, nutrients, pH, humus)
	N min
	Green manure biomass
	Green manure soil cover percentage (Braun Blanquet index)
	Leaf analyses



<b>Research Institute</b>	LAIM
<b>Organism hosting the trial</b>	LAIM
<b>Trial location</b>	Vadena (BZ) (46°23'16.0"N 11°17'21.3"E)
<b>Total core-plot area</b>	450 m <sup>2</sup>
<b>Crop species</b>	Grape
<b>Research topic</b>	Effectiveness of green manure species on soil fertility
<b>Experimental variant</b>	<i>Pisum sativum</i>
	<i>Canapa sativa</i>
<b>Experimental control</b>	No green manure
<b>N. of blocks</b>	1 + 1
<b>N. of plant per treatment per block</b>	15
<b>N. plant per treatment</b>	60
<b>Starting time</b>	Spring 2019
<b>Parameters monitored</b>	Trunk diameter
	Soil analyses (tot-N, tot-C, org-C, nutrients, pH, humus)
	N min
	Green manure biomass
	Green manure soil cover percentage (Braun Blanquet index)
	Leaf analyses





<b>Research Institute</b>	UHOH
<b>Organism hosting the trial</b>	Kompetenzzentrum Obstbau Bodensee Public
<b>Trial location</b>	Ravensburg (47°46'41.9"N 9°31'52.0"E)
<b>Total core-plot area</b>	680 m <sup>2</sup>
<b>Crop species</b>	Apple
<b>Research topic</b>	Using legumes in row and inter-row as fertilisers
<b>Experimental variant</b>	Legumes 1 (inter-row: white clover)
	Legumes 2 (inter-row: white clover and row: winter peas short)
	Legumes 3 (inter-row: micro clover)
<b>Experimental control</b>	Fertiliser as used in agricultural practice 1 (winter peas short)
	Fertiliser as used in agricultural practice 2 (horn grit)
	Fertiliser as used in agricultural practice 3 (vinasse)
	No Fertilisation
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	10
<b>N. plant per treatment</b>	30
<b>Starting time</b>	set-18
<b>Parameters monitored</b>	Apple tree growth (trunk diameter, shoot growth)
	Soil (Macro-/ Micronutrients)
	Soil N <sub>min</sub> content
	Legume and fertilisers (nutrient content)
	Fruit (yield, sugar, acid, firmness, colour, size, C and N content)





<b>Research Institute</b>	FiBL
<b>Organism hosting the trial</b>	FiBL Private
<b>Trial location</b>	Frick (Switzerland) (47°30'57.6"N 8°01'28.5"E)
<b>Total core-plot area</b>	1300 m <sup>2</sup>
<b>Crop species</b>	Apple (Variety "Ariwa")
<b>Research topic</b>	testing the effect of legume intercrops as internal source of nitrogen and its effect on soil fertility
<b>Experimental variant</b>	micro clover inter-row
	white clover inter-row
	peas intra-row
	hoed and organic fertilizer (Bioilsa 11) intra-row
	peas intra-row and white clover inter-row
<b>Experimental control</b>	hoed without fertilizer intra-row
<b>N. of blocks</b>	3
<b>N. of plant per treatment per block</b>	13 to 14 (assessments on 5 trees in the middle of each block)
<b>N. plant per treatment</b>	39 to 42
<b>Starting time</b>	spring 2019
<b>Parameters monitored</b>	<b>soil:</b>
	Nmin ( 0-30 cm depth)
	ev. available P, K, Mg, Ca
	ev. C, N, S
	ev. Exchangeable bases, cation capacity
	<b>peas:</b>
	Plant density (Plants/m <sup>2</sup> )
	Biomass production
	<b>apple trees:</b>
	Trunk circumference (cm)
	Flowering intensity (1-9)
	Fruit setting (1-9)
	Shoot length rating
	Diseases/Pests/Mice on occurrence
	Yield (kg) per tree
	Fruit size (mm) in a mixed sample per replicate
	Colour of fruits in a mixed sample per replicate
	<b>plant material:</b>
	Apples: sugar, acid, firmness
	Apples: ev. C, N
Clover: biomass production	
Clover: ev. K, Ca, C, N	