L'ESPERIENZA DEL PROGETTO "DOMINO" SU COLTURE FRUTTICOLE E VITE

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Dynamic sod mulching and use of recycled amendments to increase biodiversity, resilience and sustainability of intensive organic fruit orchards and vineyards

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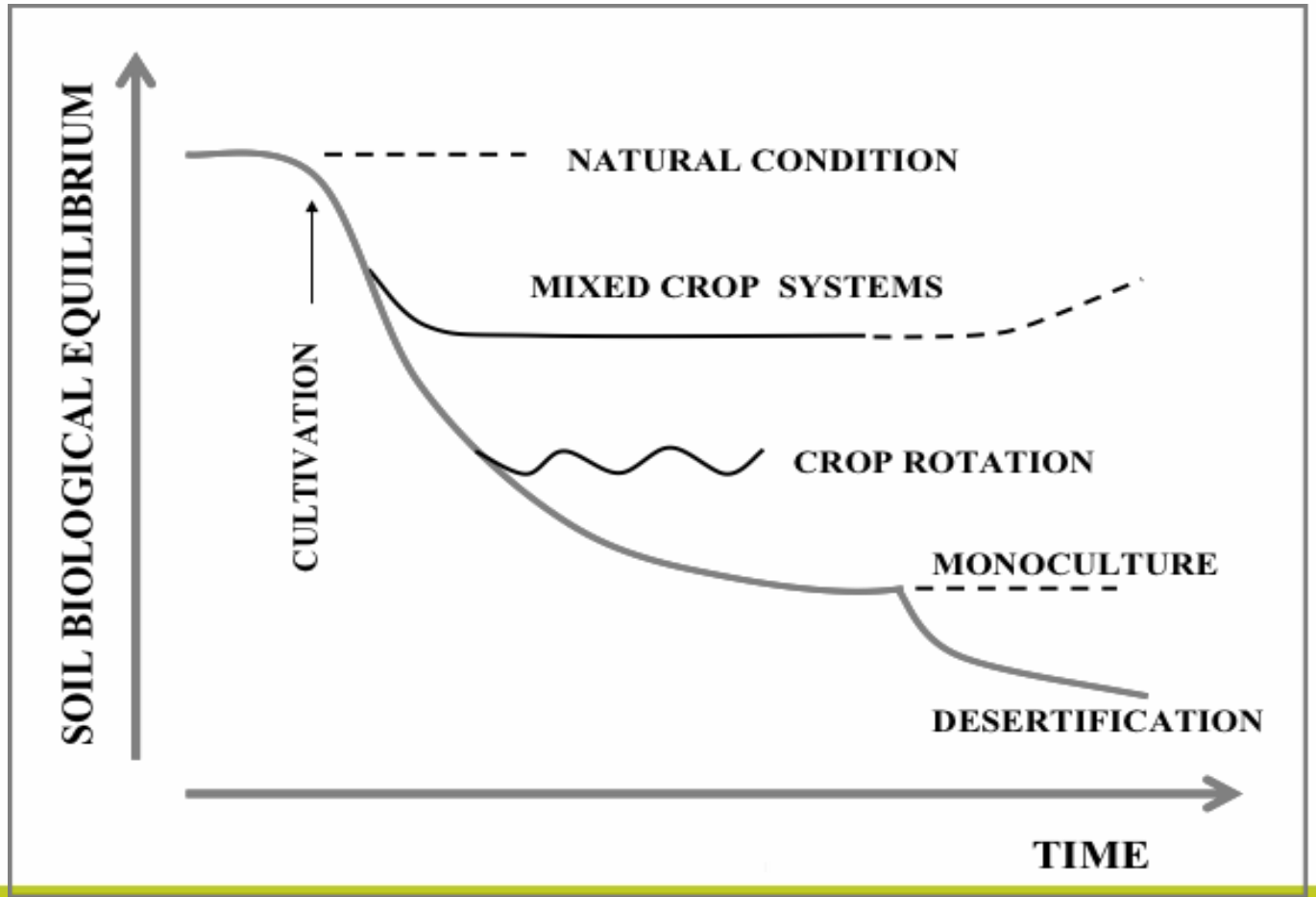
Starting date: 1° May 2018

Rationale 1

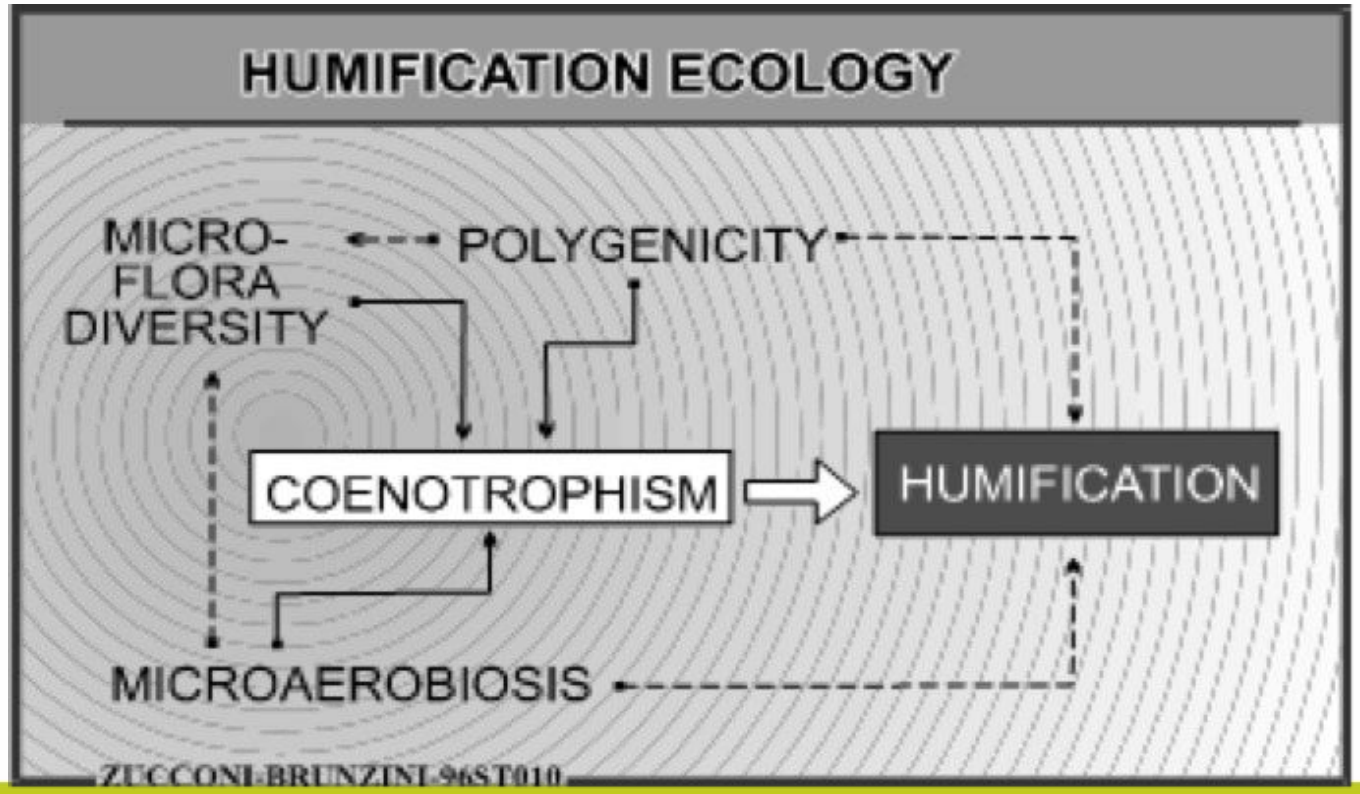
Improve long-term sustainability of **intensive organic orchard** and **vineyard** by innovative strategies expected to **increase biodiversity** as a source of resilience for the agroecosystems, and to **reduce the dependency on external input**.



Modified from Zucconi, 1996

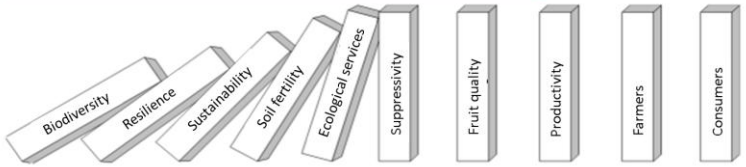
Rationale 2

- Focus on the **interaction** of fruit trees with different wild species, organic residues and microbioma.
- To break the paradigm of monoculture in organic fruit growing by the development of new intercropping strategies and amendments to increase the sustainability of organic fruit growing and to maintain ecosystem services.



Zucconi, 1996

CORE organic DOMINO



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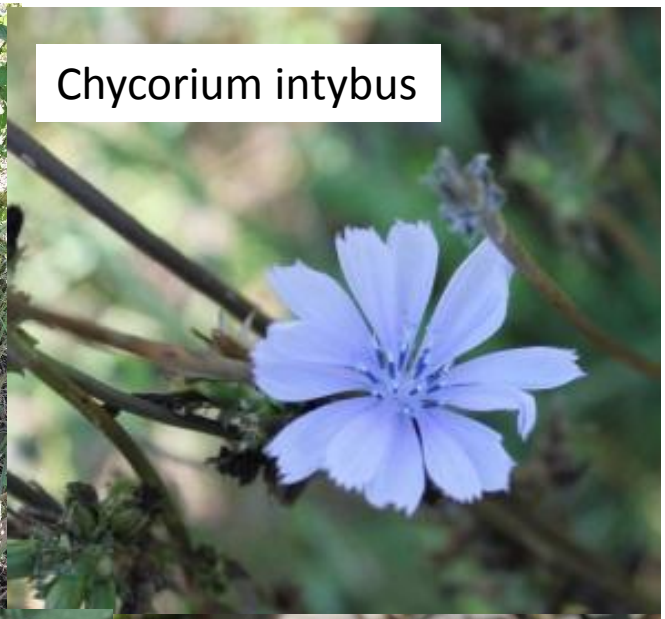
Living mulches: not weed but herbs


Portulaca spp.


Fragaria spp.


Chycorium intybus


Polygonum aviculare

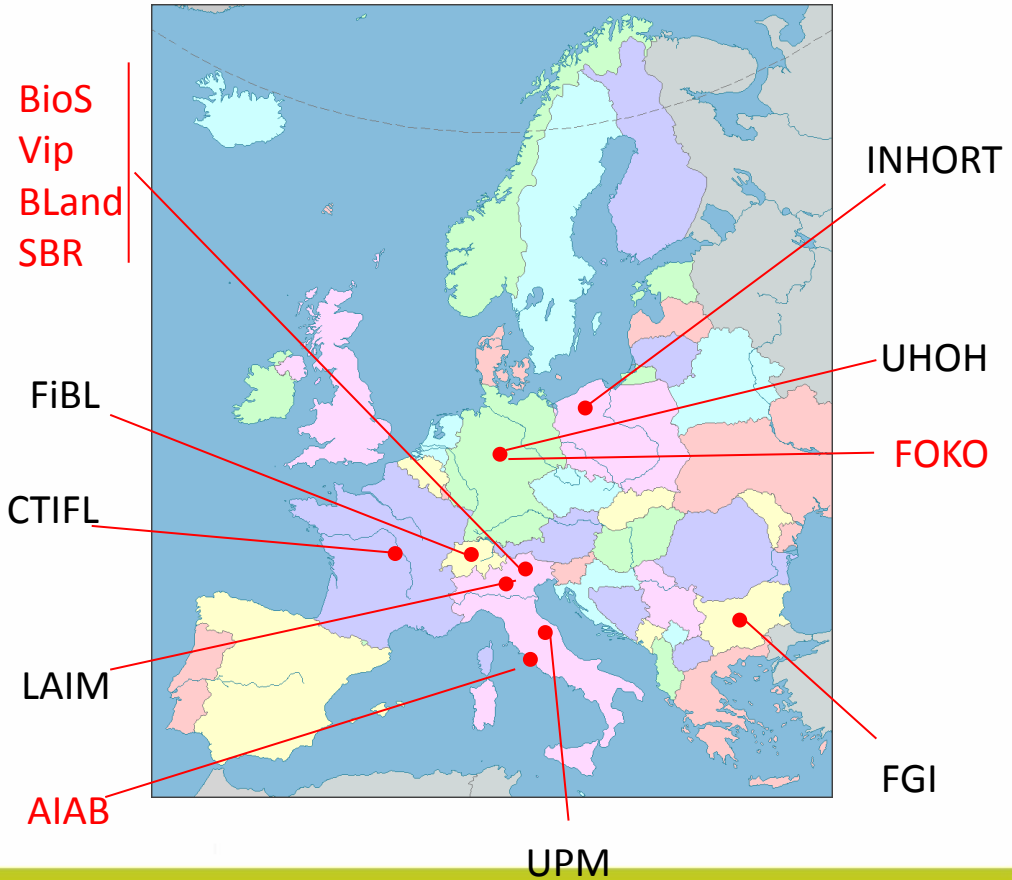

Mentha spp.


Potentilla spp.

DOMINO consortium and location

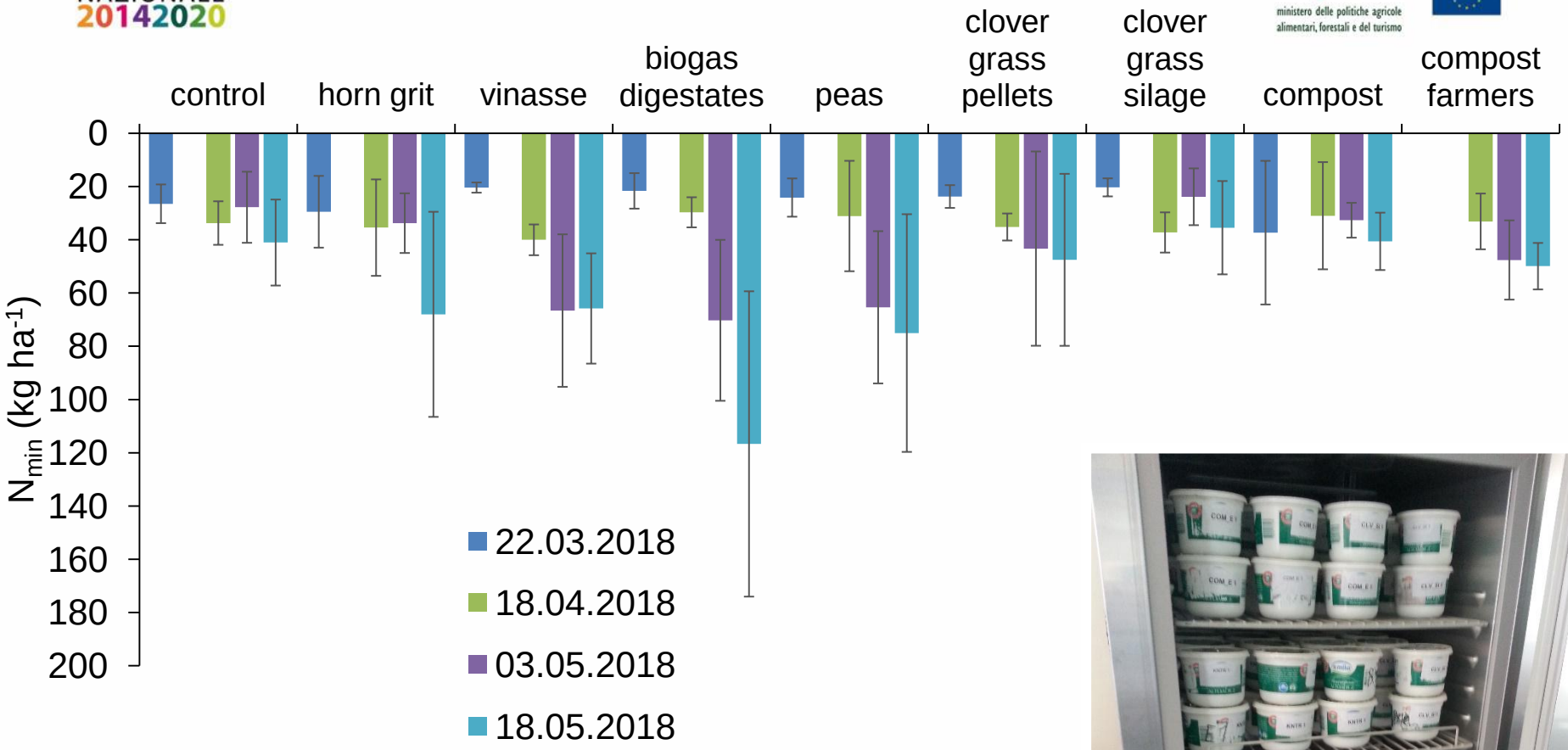
UPM	Polytechnic University of Marche, IT
FGI	Fruit Growing Institute, BG
LAIM	Laimburg Research Centre, IT
INHORT	Institute of Horticulture, PL
CTIFL	C.T.I. Fruits Légumes, FR
FiBL	R.I. of Organic Agriculture, CH

BioS	BioSudtirol, IT
Vip	Vi.P Bio Vinschgau, IT
BLand	Bioland Südtirol, IT
SBR	SBR organic, IT
AIAB	Ass. It. Agricoltura Biologica, IT
UHOH	University Hohenheim, DE
FOKO	Fördergemeinschaft Ökologischer Obstbau e.V., DE

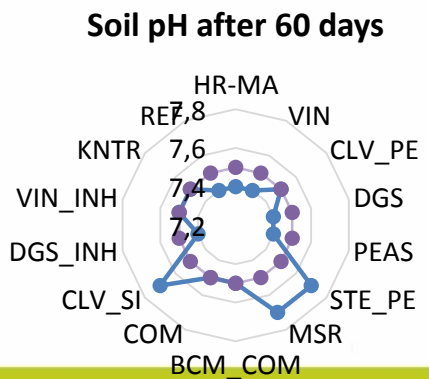


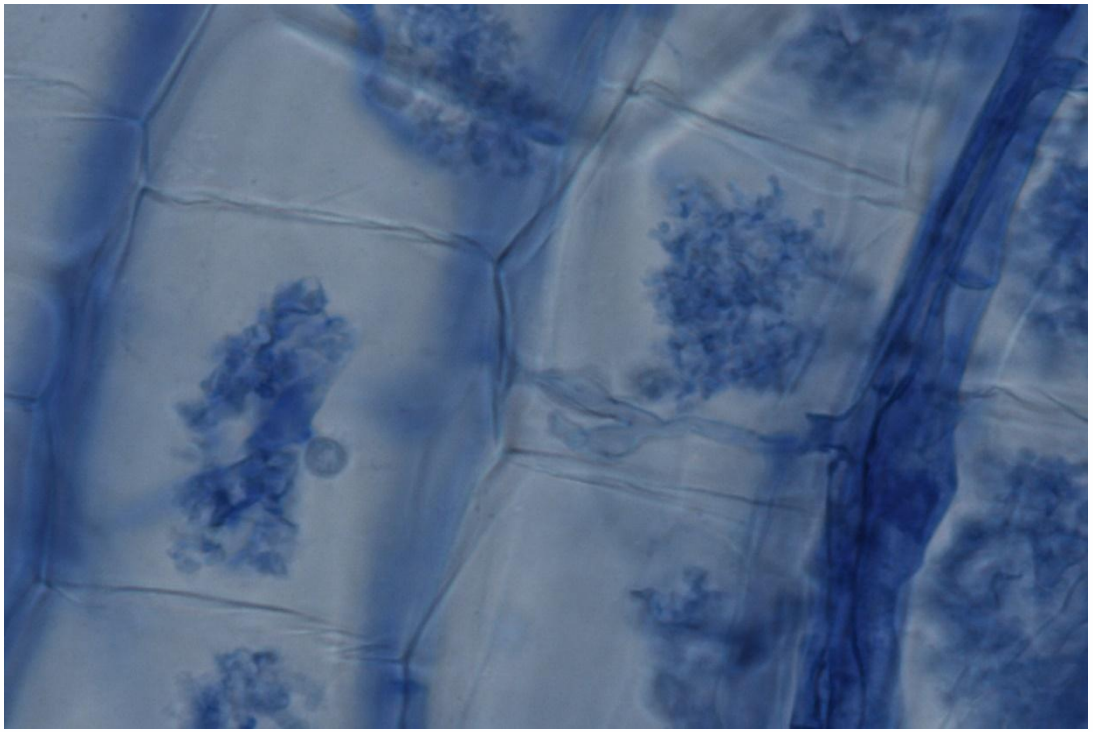
The proposed strategy includes:

Introduction of new cash intercropping species, expected to contribute to plant nutrition and protection while increasing biodiversity;



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;





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InHort
INSTYTUT OGRODNICTWA

Introduction of microbial-based products

for plant nutrition and protection to promote soil biodiversity and enhance inputs efficiency;

RETERURALE NAZIONALE 20142020

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Versuchszentrum
Centro di Sperimentazione
Research Centre
LAIMBURG

Introduction of overhead netting and partial cover systems for crop protection;

UNIVERSITY OF HOHENHEIM

Overall designing of orchard management to promote eco-services.

Ctifl

Dissemination tools


SPEZIAL SÜDTIROLER LANDWIRT NR. 20 9.11.2018

Mehr Nachhaltigkeit dank DOMINO

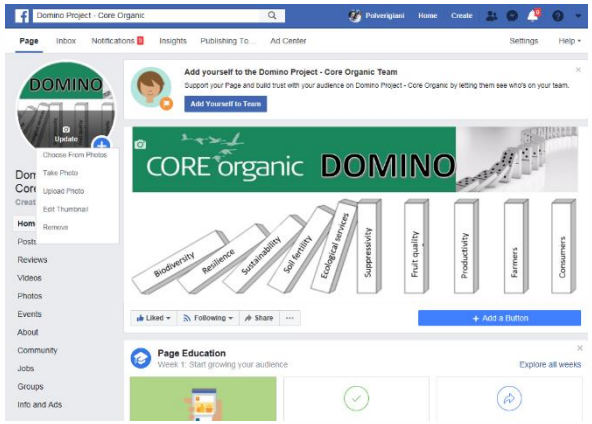
DOMINO ist ein neues, innovatives Management von Apfelanlagen. Gemeinsam mit Partnern will das Versuchszentrum Laimburg die Fruchtbarkeit, Biodiversität und ökonomische Nachhaltigkeit der Anlagen steigern.

Das Project DOMINO verfolgt das Ziel, neue Technologien, Techniken und Maßnahmen zu entwickeln und zu bewerten, die den Bioanbau nachhaltiger gestalten sollen. Finanziert wird das dreijährige Projekt, das am 1. April 2018 angelaufen ist, von „CORE Organic" (Coordination of European Transnational Research in Organic Food and Farming Systems). An dem Projekt beteiligt sind neben dem Versuchszentrum Laimburg noch weitere sechs europäische Forschungseinrichtungen: [INRAE – Pollen, Cluff – Frankreich, Universität Hohenheim – Deutschland, FiBL Schweiz, FGI – Bulgarien], wobei die Koordination bei der Università Politecnica delle

National technical journals

Videos

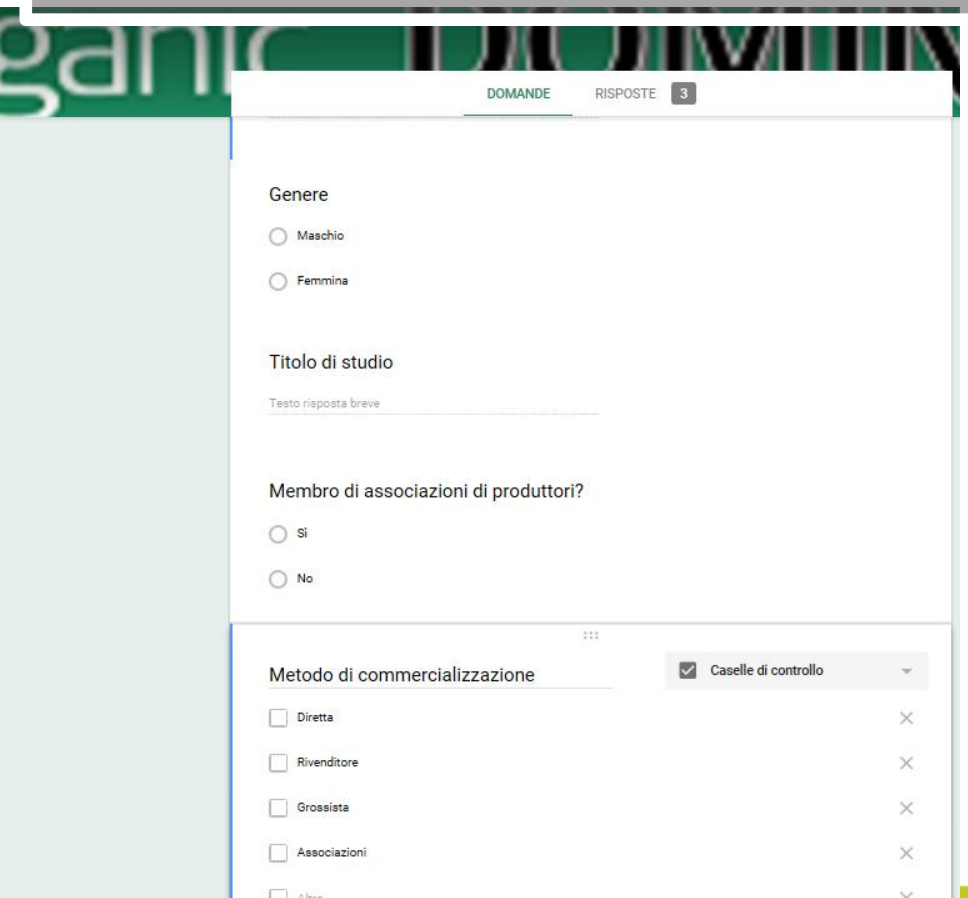
Domino-Project-Core-Organic

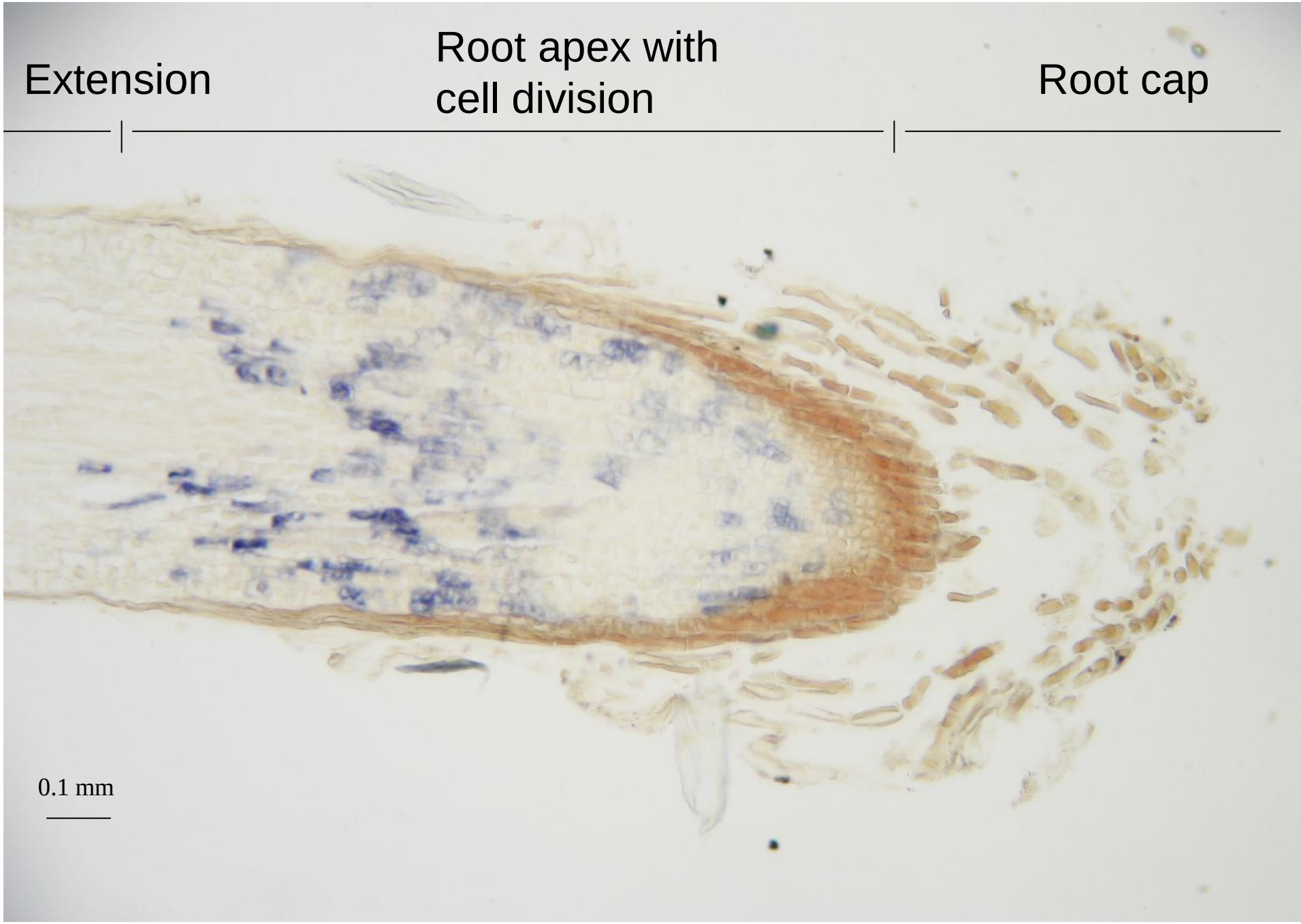


http://www.domino-coreorganic.eu/

Methodology

The project is based on a multi-stakeholder approach which includes different actors (farmers, extension, researchers, agricultural administration)

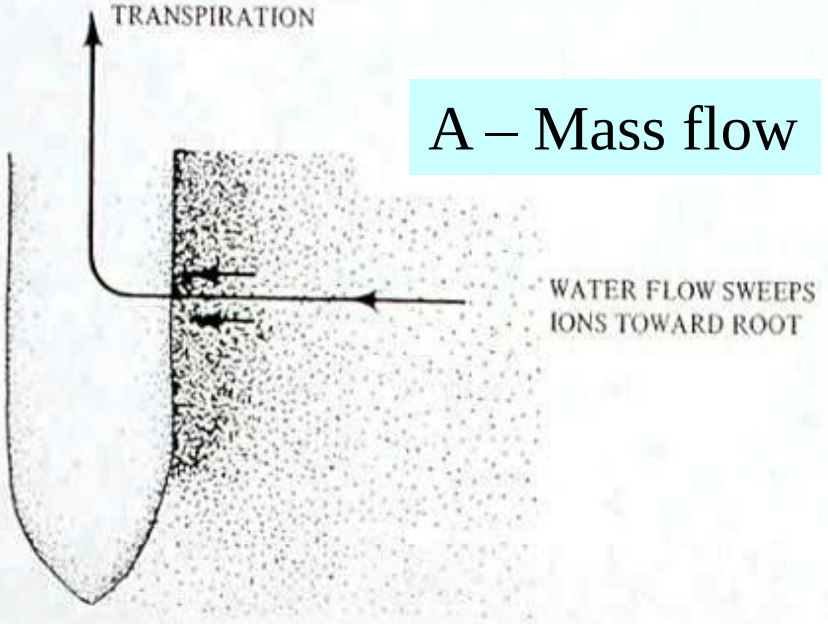




Strawberry, Neri et al. 2011

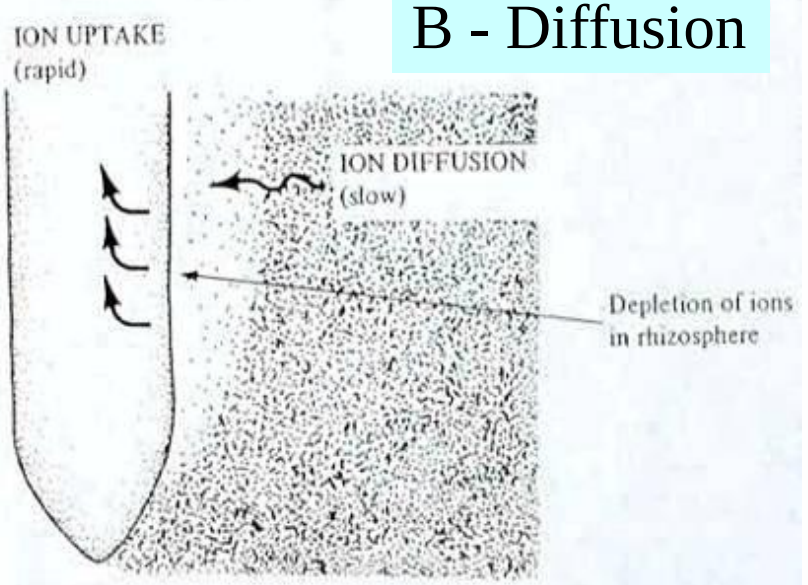
SOIL NUTRIENT "MOBILITY" AND AVAILABILITY

1. ION MOVEMENT TOWARD ROOT(S)
   a.) Mass flow in soil solution.
   b.) Ionic diffusion to root



A – Mass flow

B - Diffusion

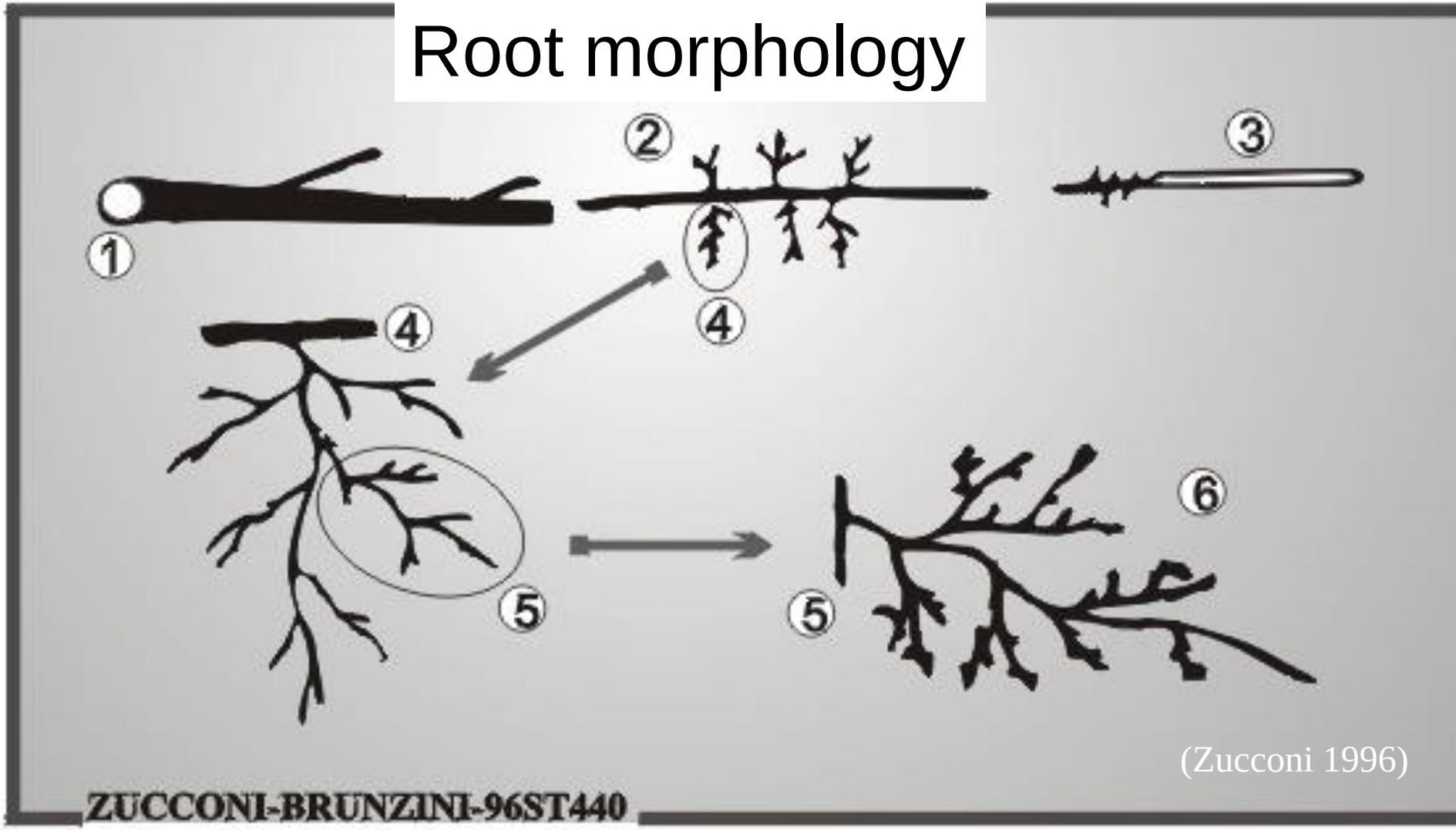


2. ROOT MOVEMENT (I.E., GROWTH) TOWARD NUTRIENT

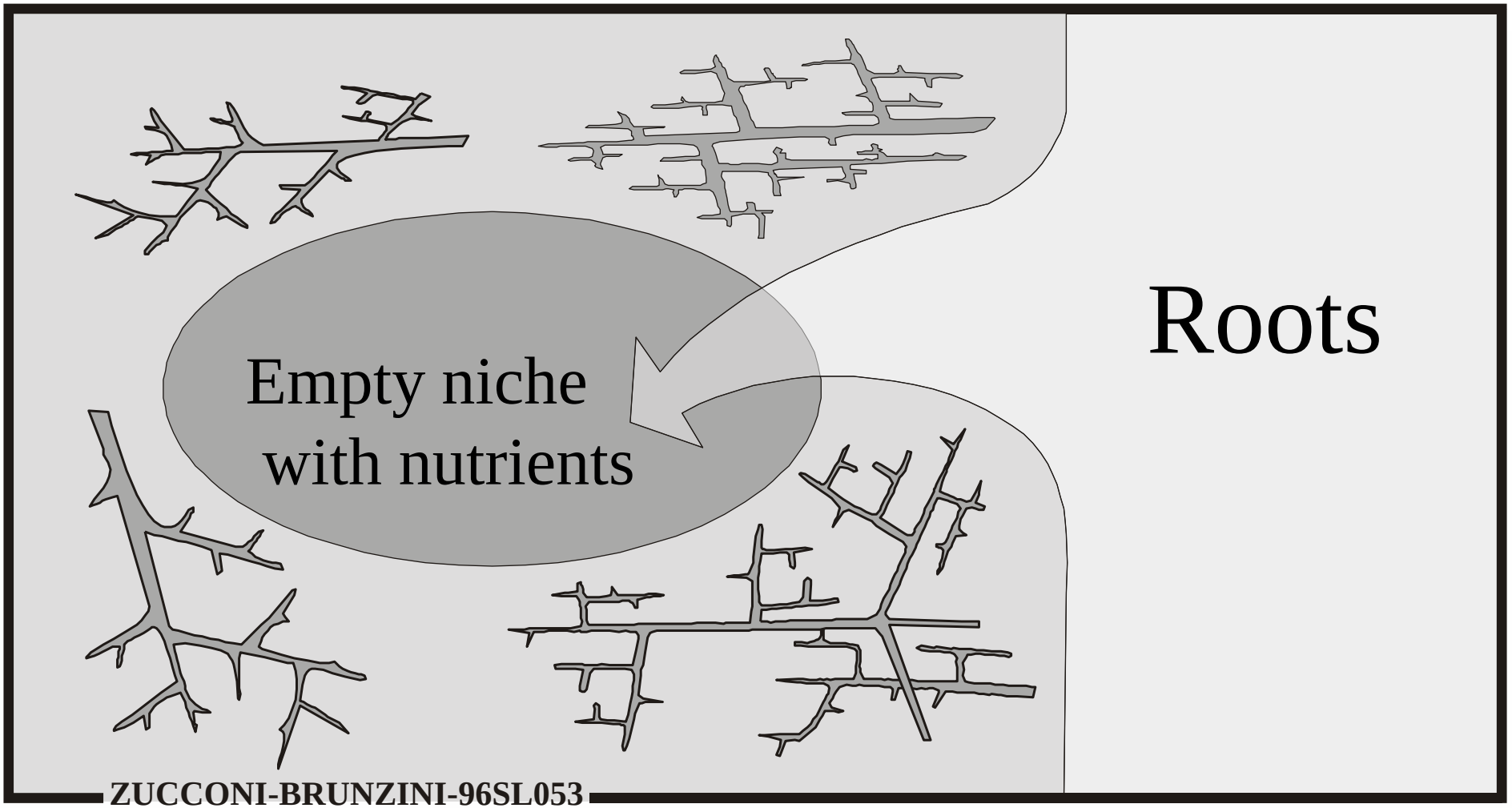
C - Interception

(Marschner 1995)

Root morphology

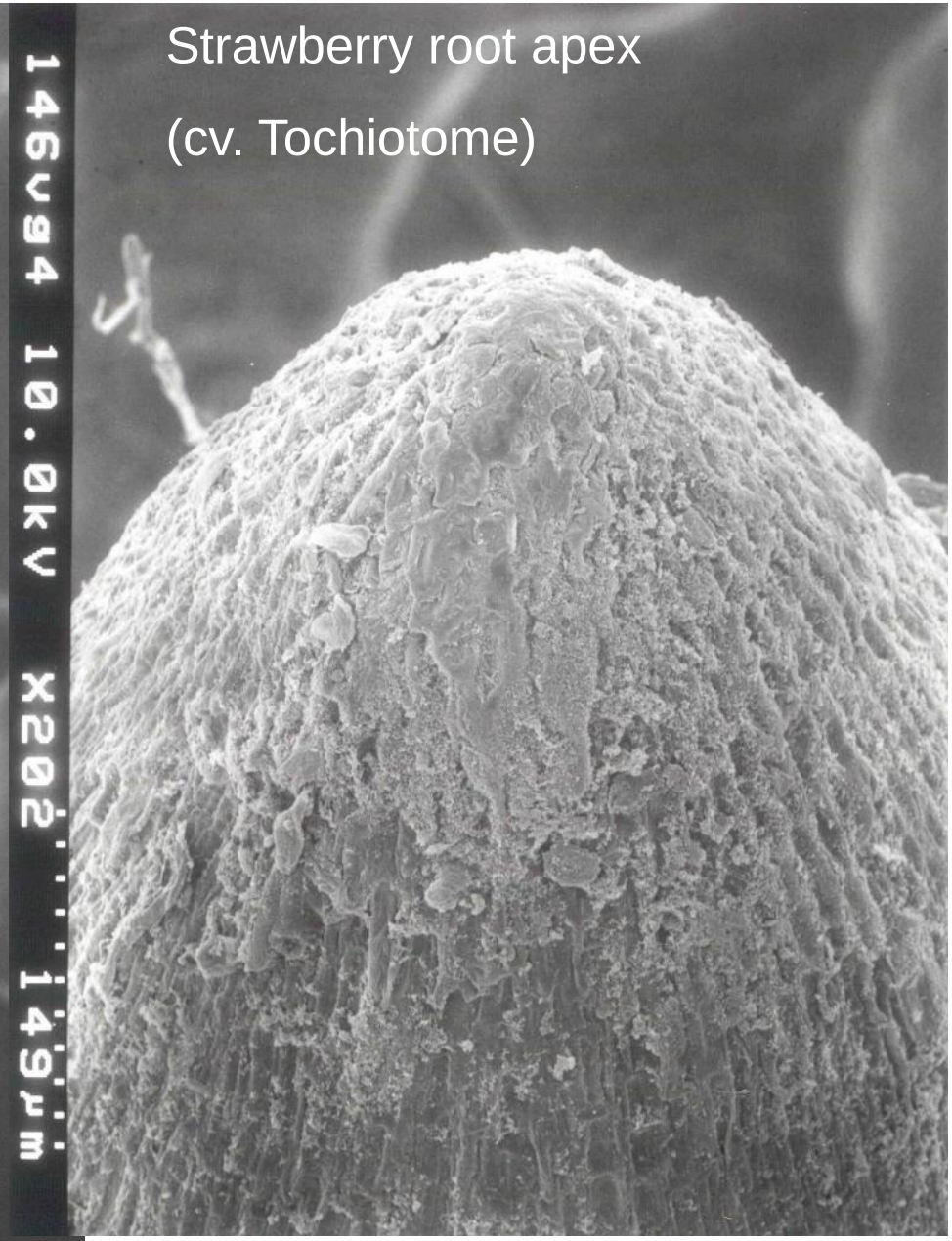


1 – root skeleton
2 – transport and sustain
3 – macro migration
4 – sustain root micromigration
5 – absorbtion (micromigration)
6 - mycorrhizae



ROOT PLASTICITY

(Zucconi 1996)



Strawberry root apex

(cv. Tochiotome)

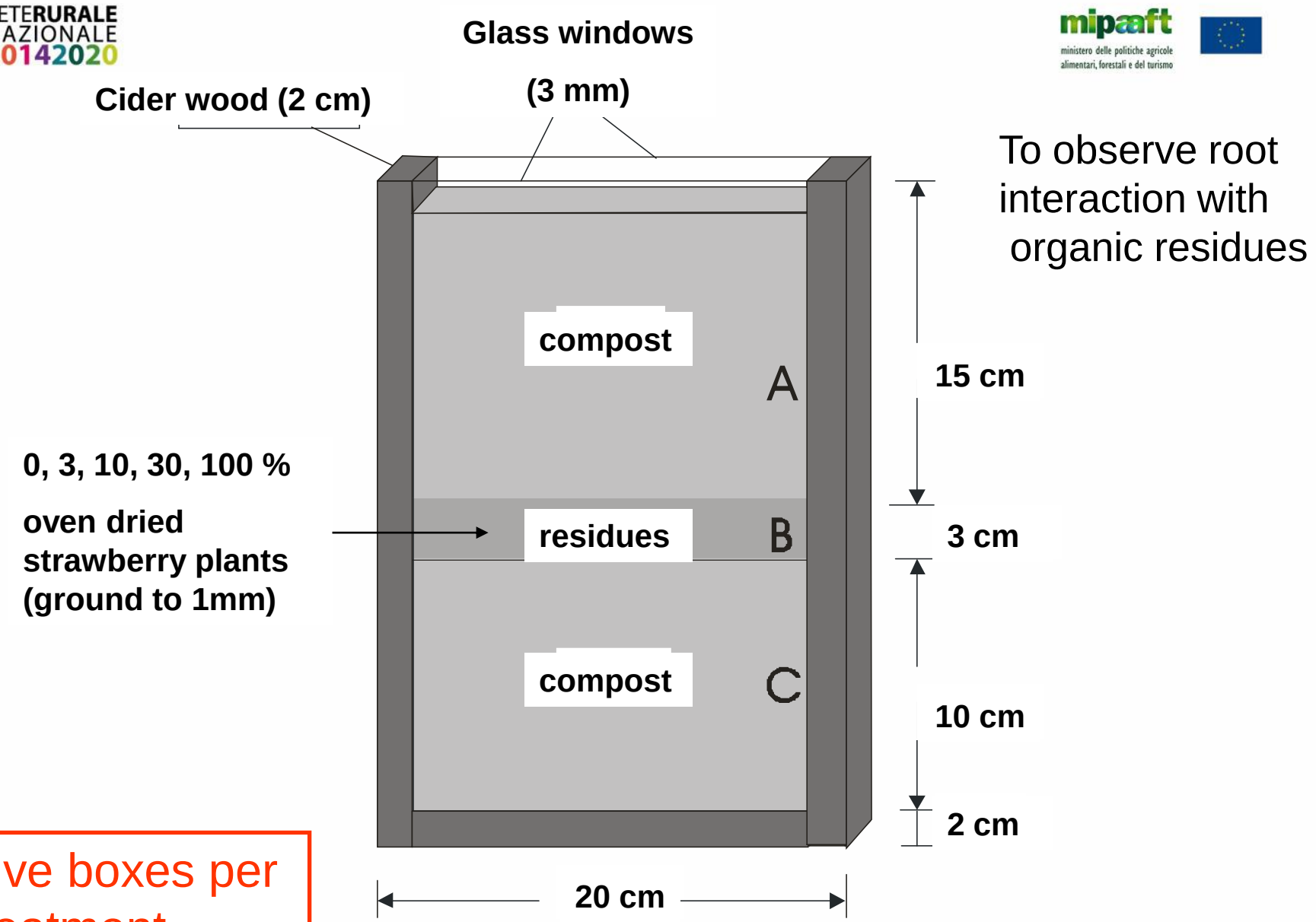
Neri , Inujima, Sugiyama 2002


OLIVE
Compost in trenches in two sides

PEACH

Allelopathy

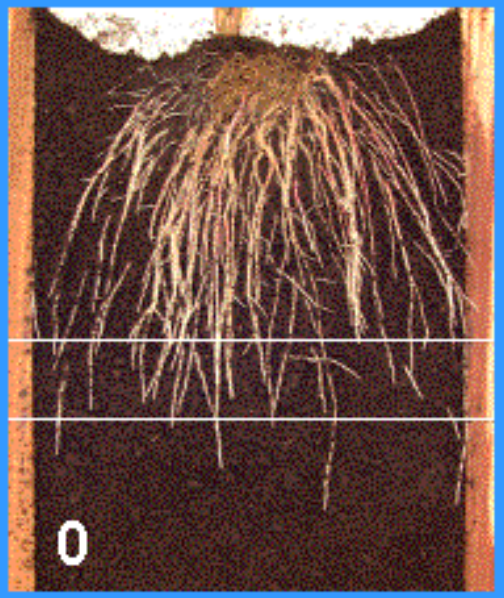
If the roots of trees grow in monospecific orchards there is a dyspatic reaction

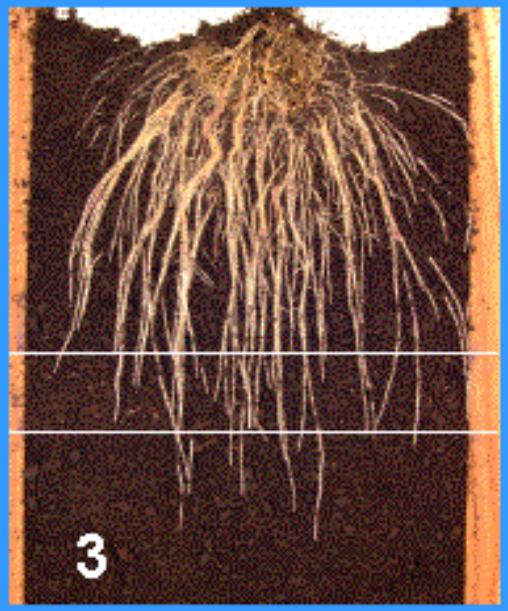


To observe root interaction with organic residues

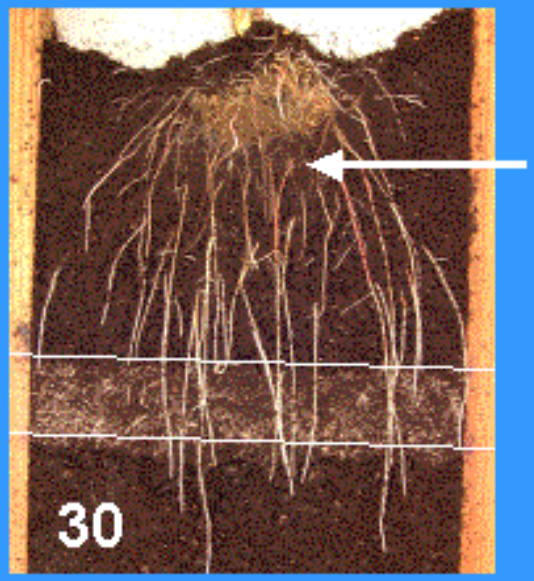
Five boxes per treatment

(Neri, Sugiyama, Inujima, 2002)

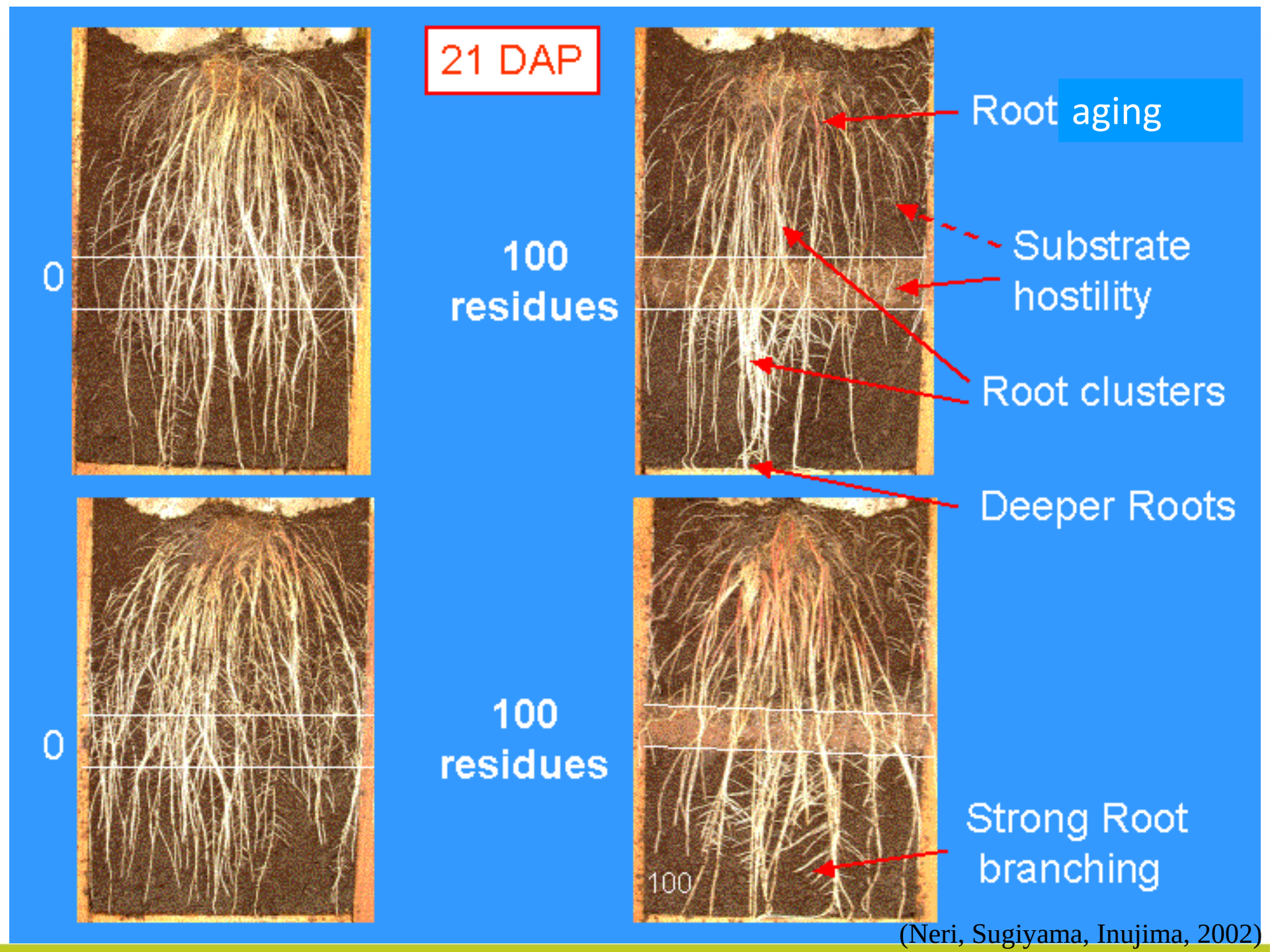




12 days after planting

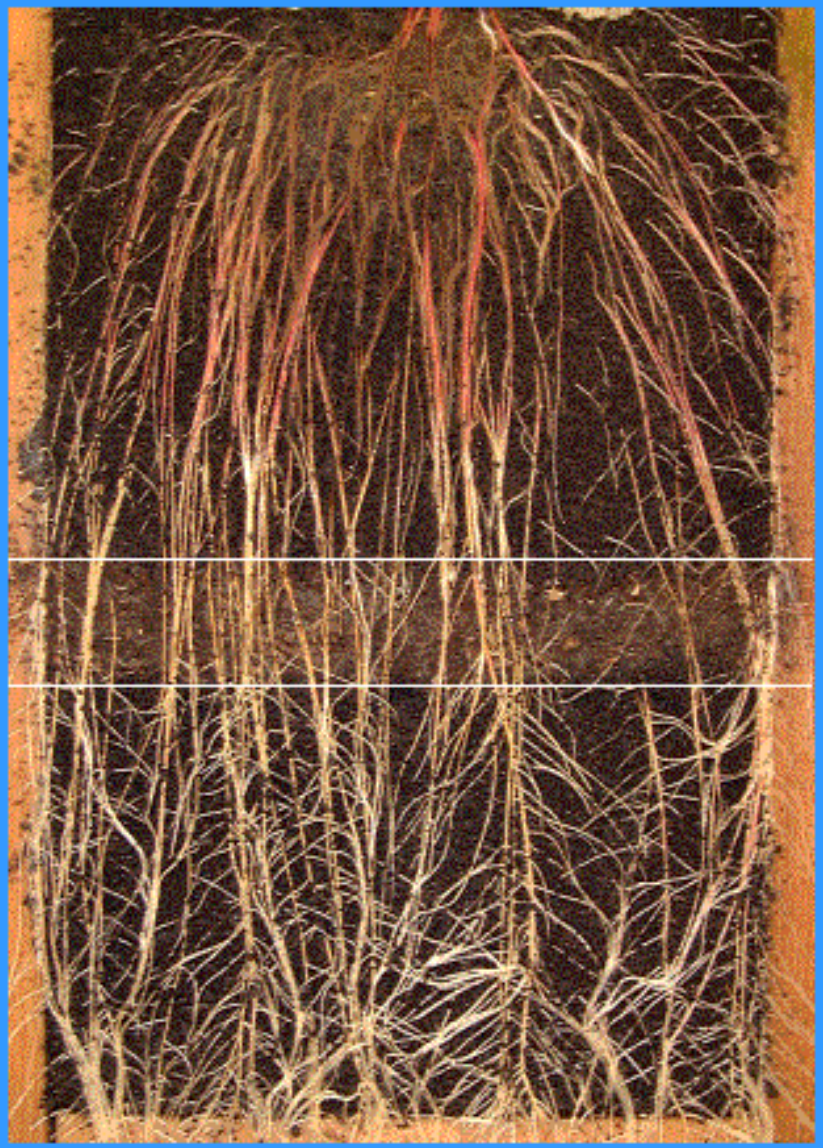


(Neri, Sugiyama, Inujima, 2002)



(Neri, Sugiyama, Inujima, 2002)

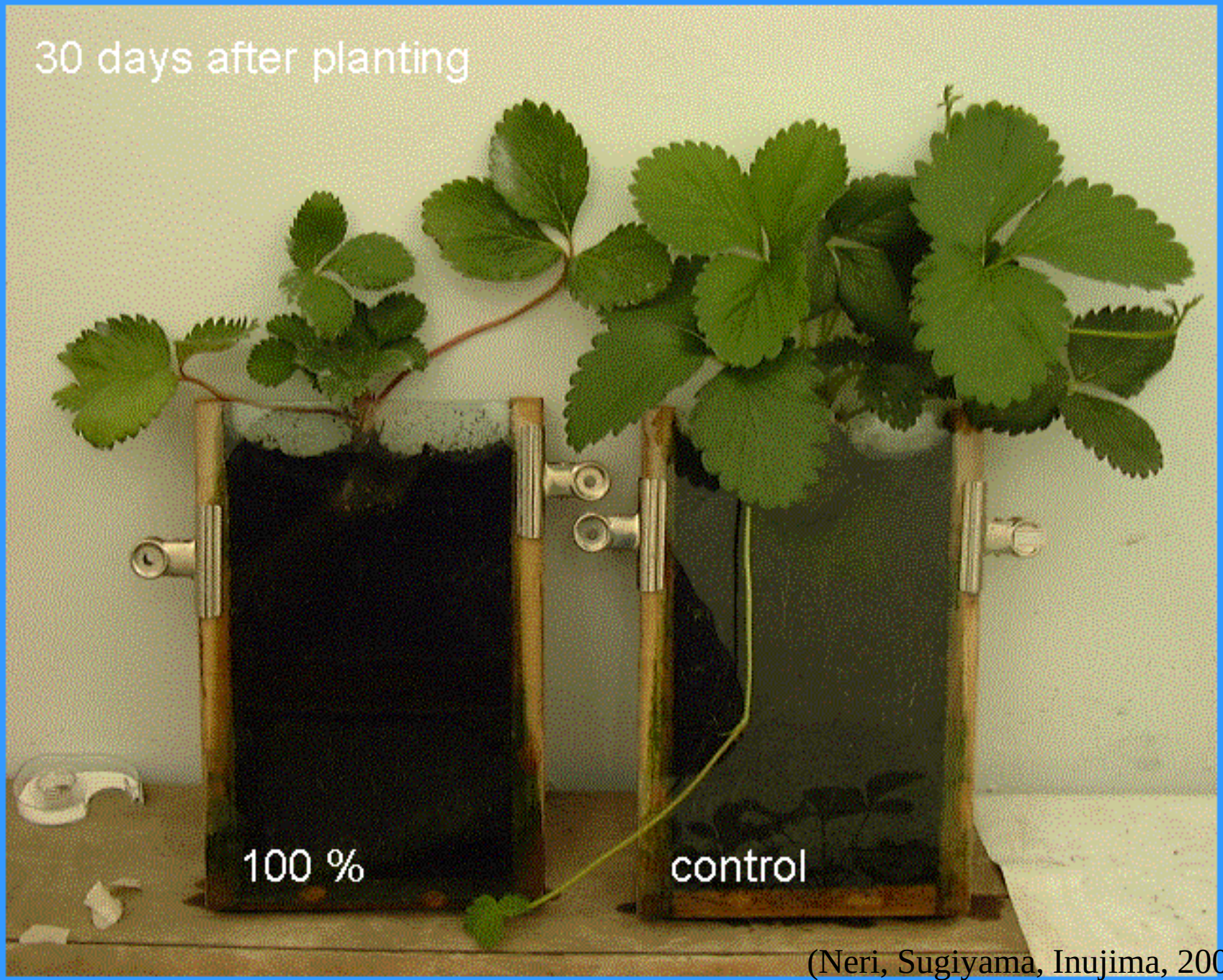
30 days after planting



Control

100 %

(Neri, Sugiyama, Inujima, 2002)



(Neri, Sugiyama, Inujima, 2002)

Apple M9

at the end of the 2° year without residues

(Mascanzoni, Zucconi, Neri 1996)

Apple residues <1mm at the end of the 2° year

(Mascanzoni, Zucconi, Neri 1996)

M9 at the end of the 2° year with apple residues in the top laye

M9 at the end of the 2° year with apple residues in the bottom

(Mascanzoni, Zucconi, Neri 1996)

control **with apple residues**

M106 at the end of the 2° year

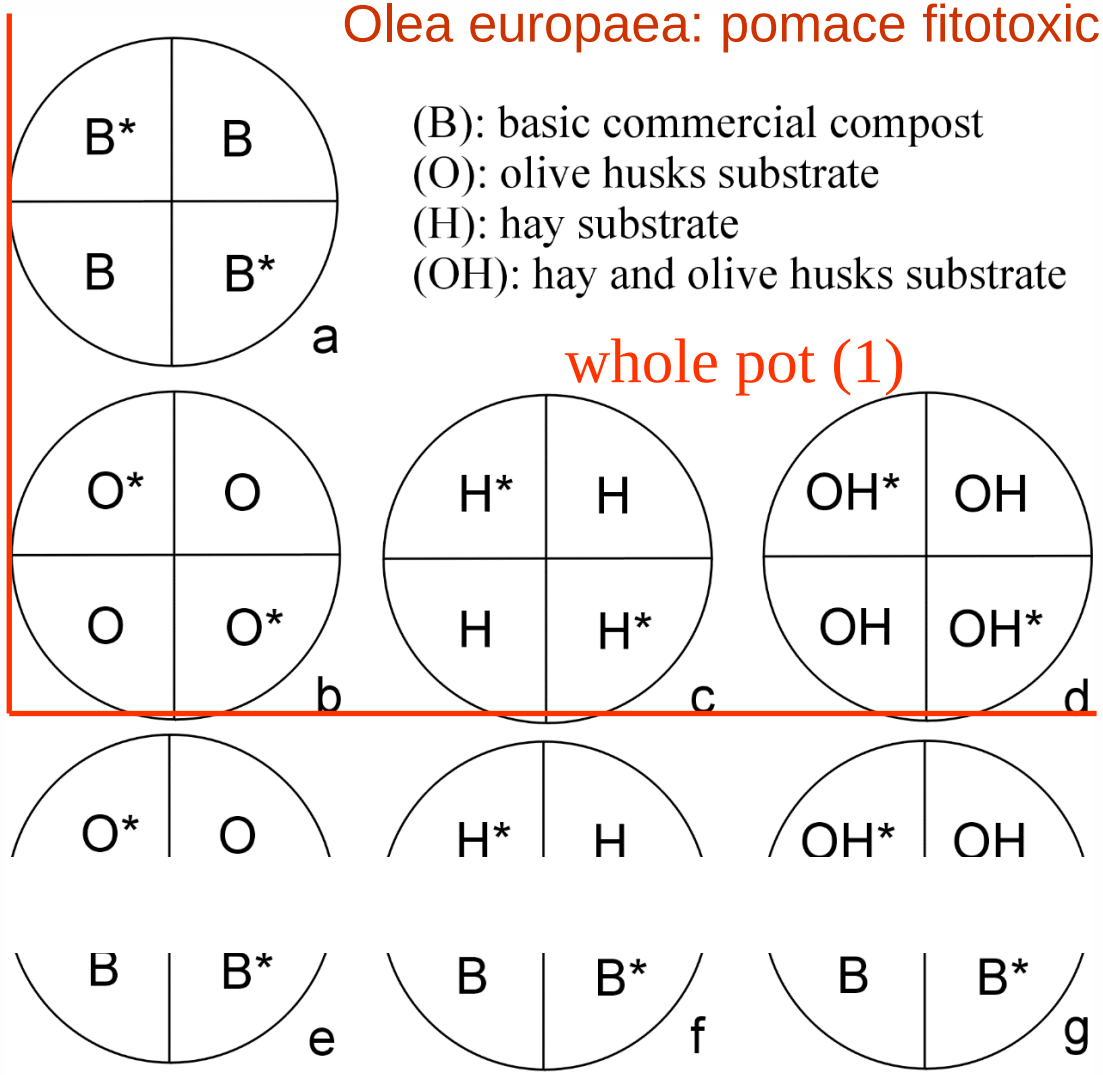
(Mascanzoni, Zucconi, Neri 1996)

M9 at the end of the 2° year with peach residues

Giorgi, Neri, Lodolini, Savini 2008

Olea europaea: pomace fitotoxicity

Olea europaea: pomace fitotoxicity



(B): basic commercial compost
(O): olive husks substrate
(H): hay substrate
(OH): hay and olive husks substrate

whole pot (1)

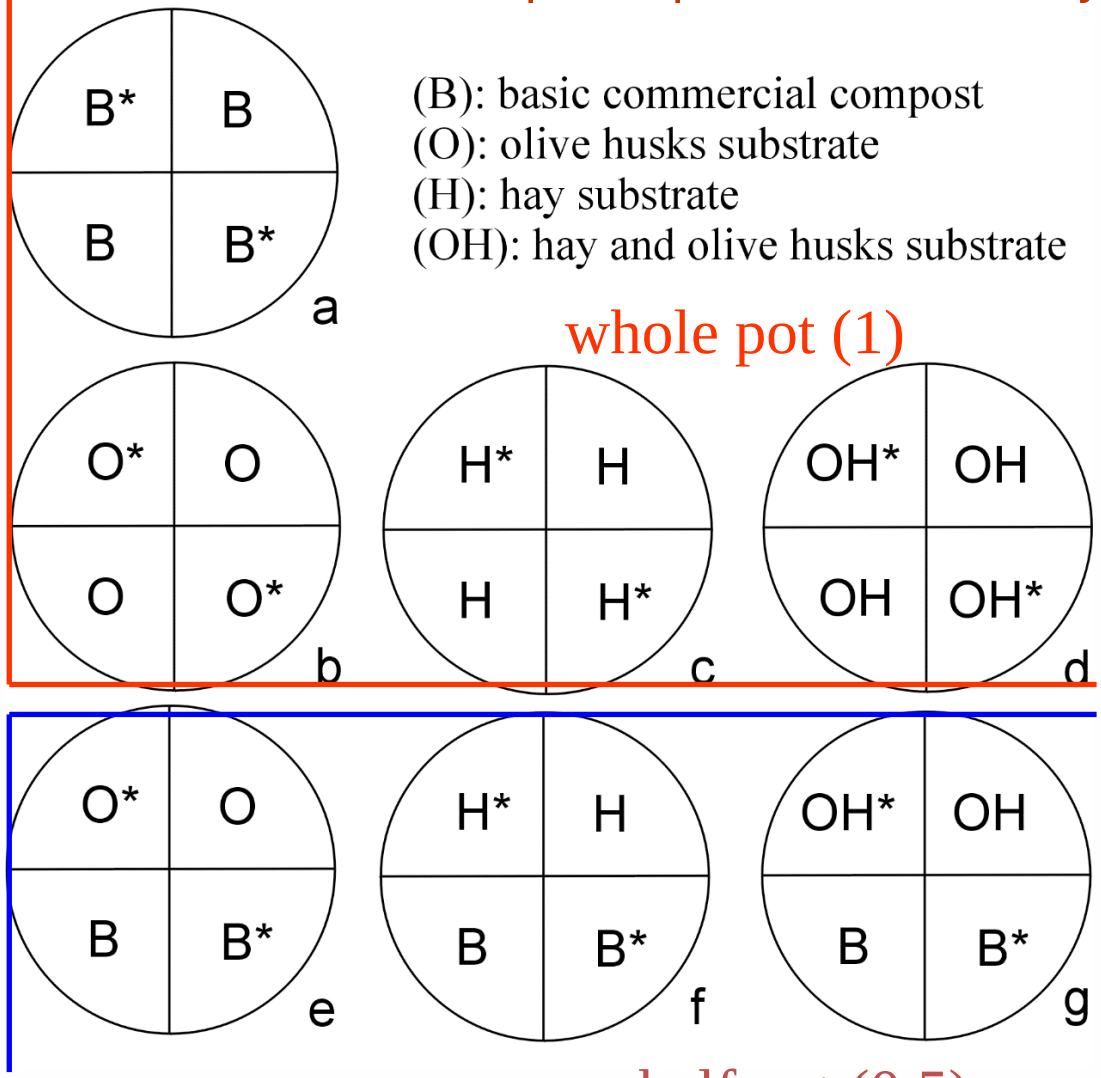
Two factors experiment

- Substrate
  - compost
  - pomace (olive husk)
  - hay
  - hay plus pomace
- Location:
  - whole pot (1)
  - half pot (0.5)

Giorgi, Neri, Lodolini, Savini 2008

(8 replicates)

Olea europaea: pomace fitotoxicity



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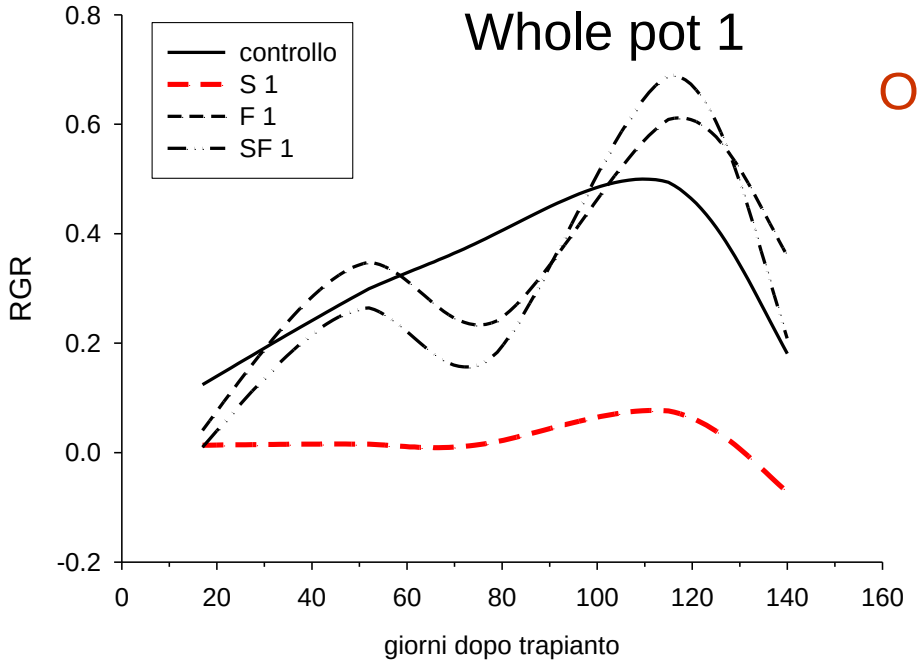
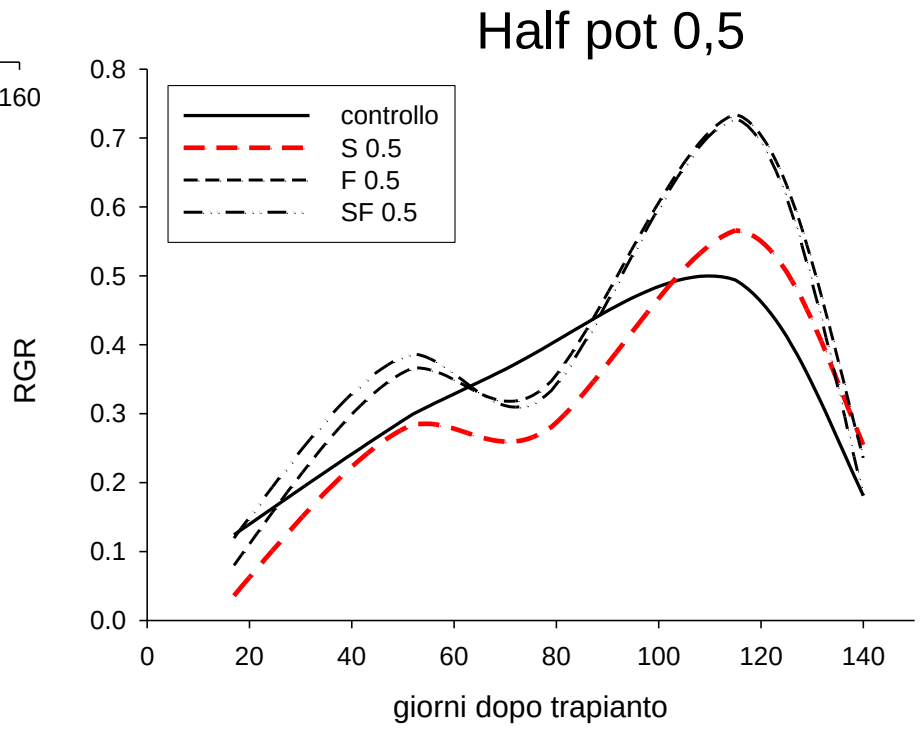
Giorgi, Neri, Lodolini, Savini 2008



Olea europaea: pomace fitotoxicity

Shoot growth rate

Niche effect



RGR = relative growth rate

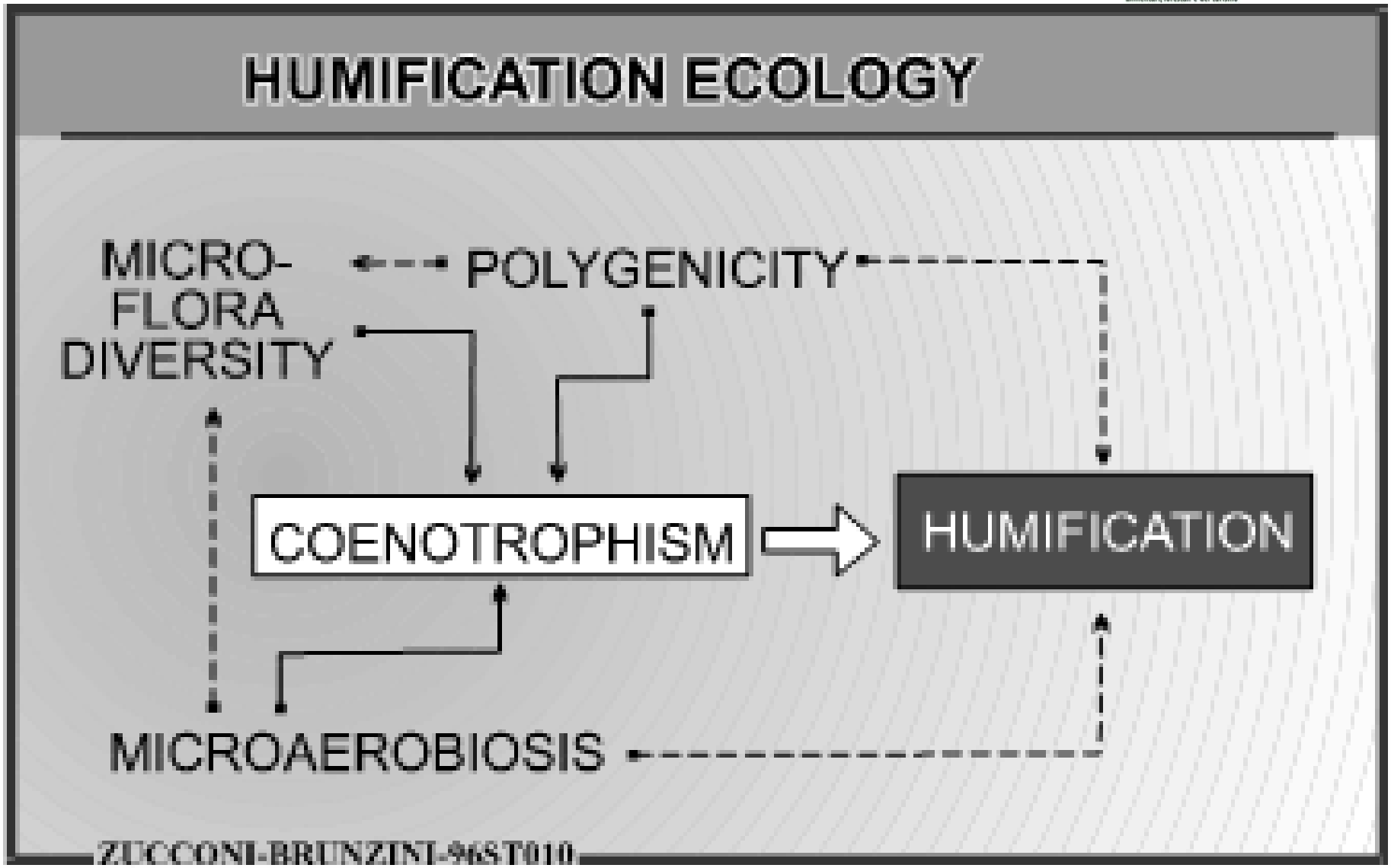
RGR = (L2 – L1) / L1

Giorgi, Neri, Lodolini, Savini 2008

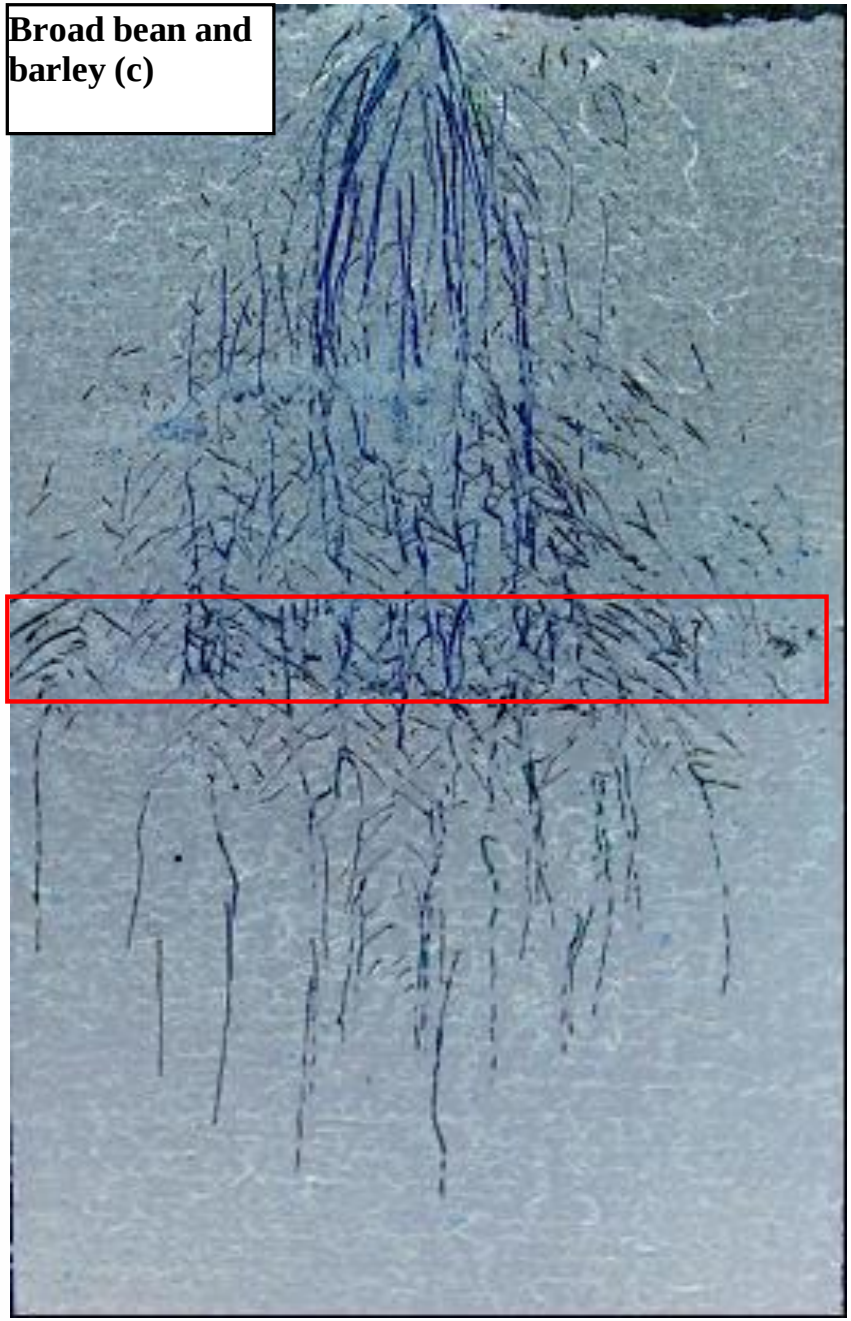
Environmental mitigation of organic waste

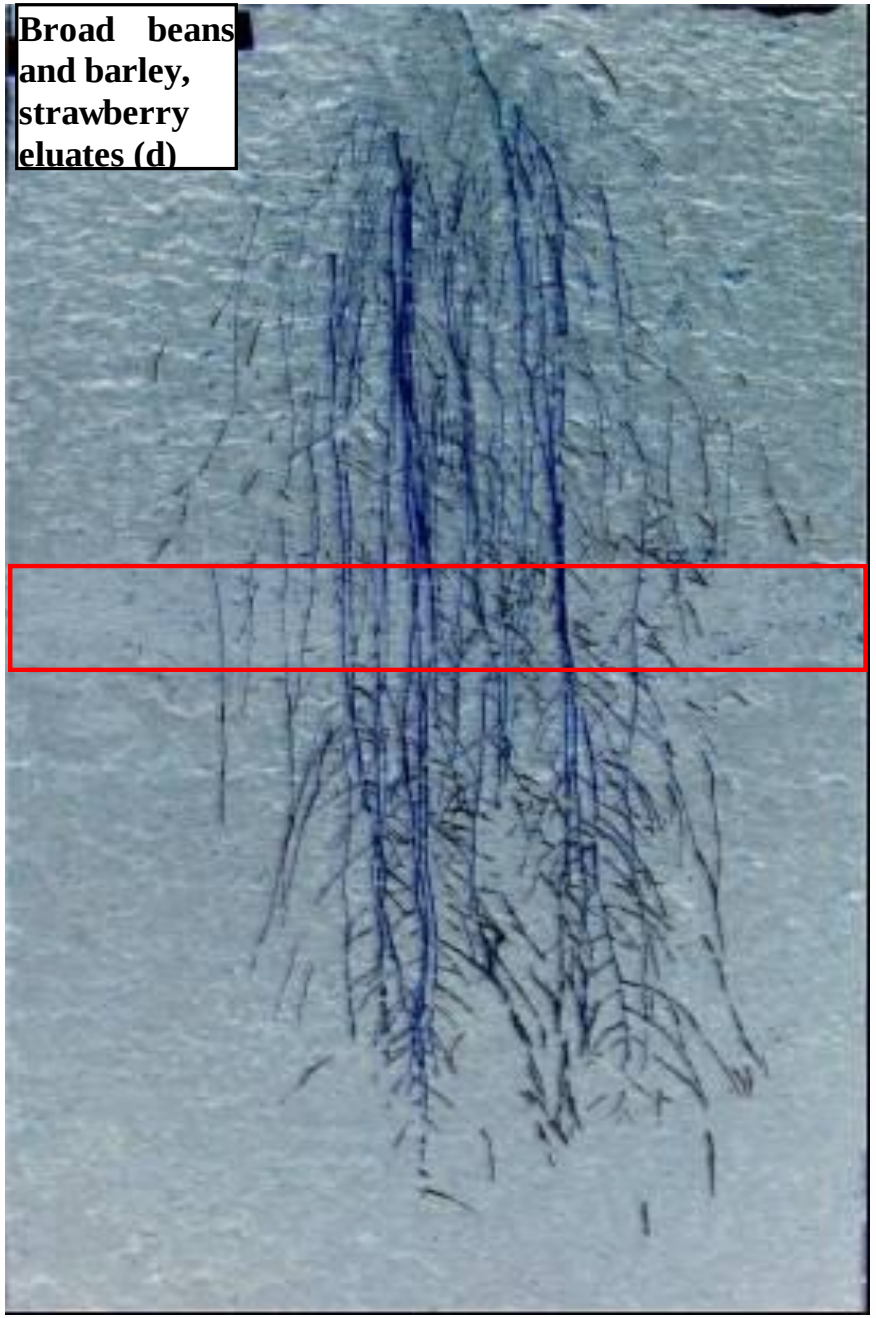
Bovine mannure

(Mascanzoni, Zucconi, Neri 1996)



(Zucconi 1996)





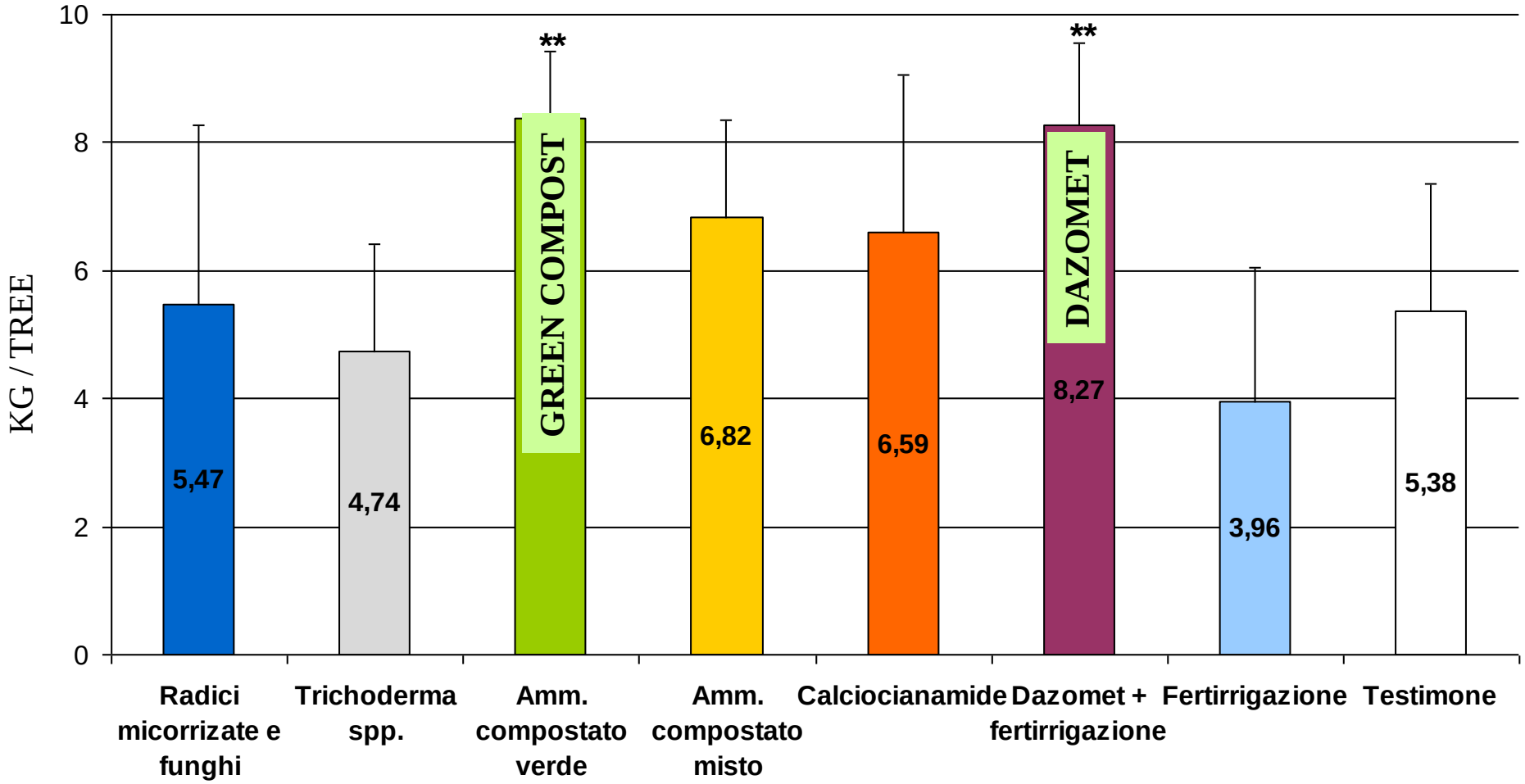
16 days after transplanting

(Neri, Sugiyama, Inujima, 2002)

Organic alternatives to soil disinfection in apple replant

(CRESO 2012)

FRUIT PRODUCTION PER TREE AT THE SECOND YEAR

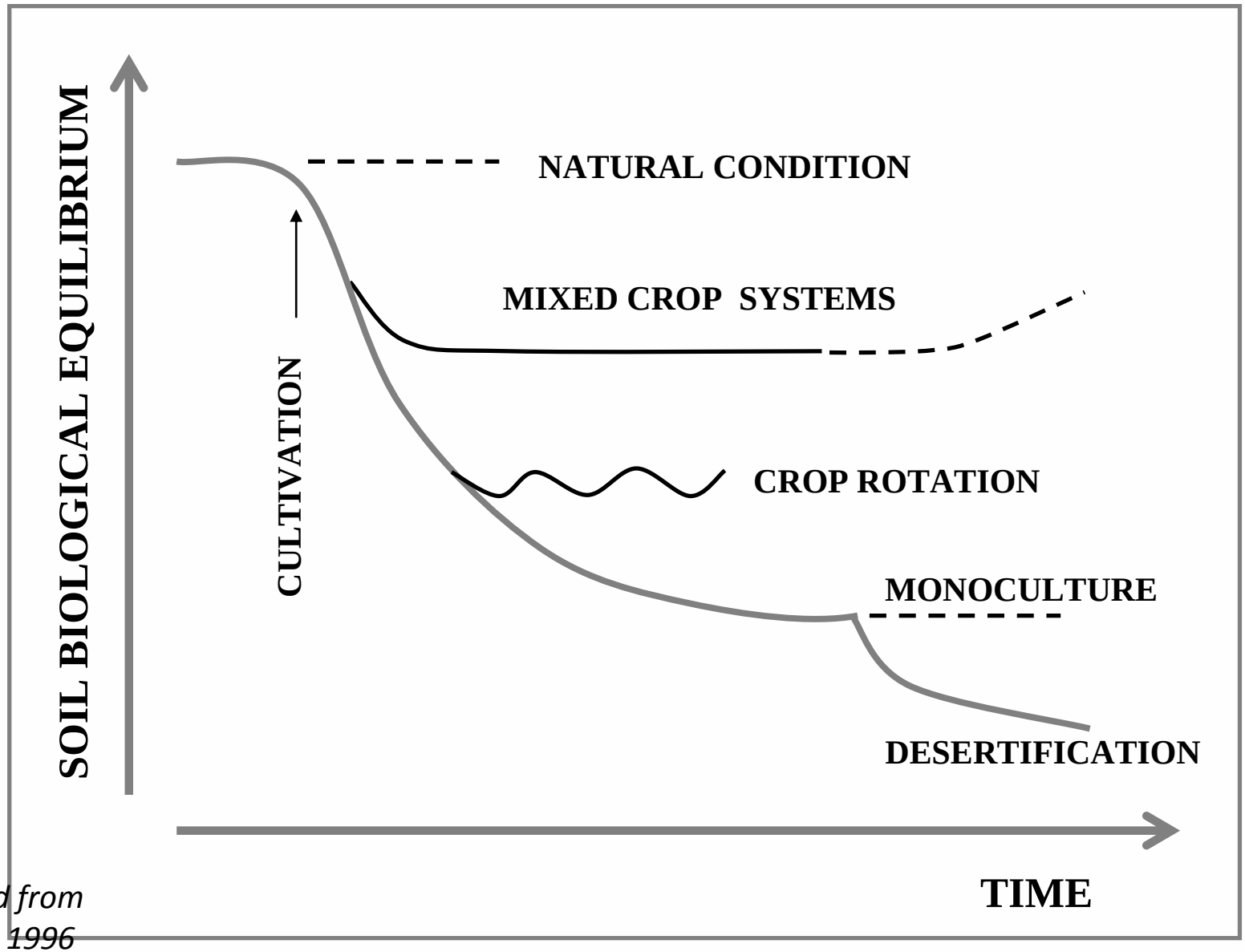


(CRESO 2012)

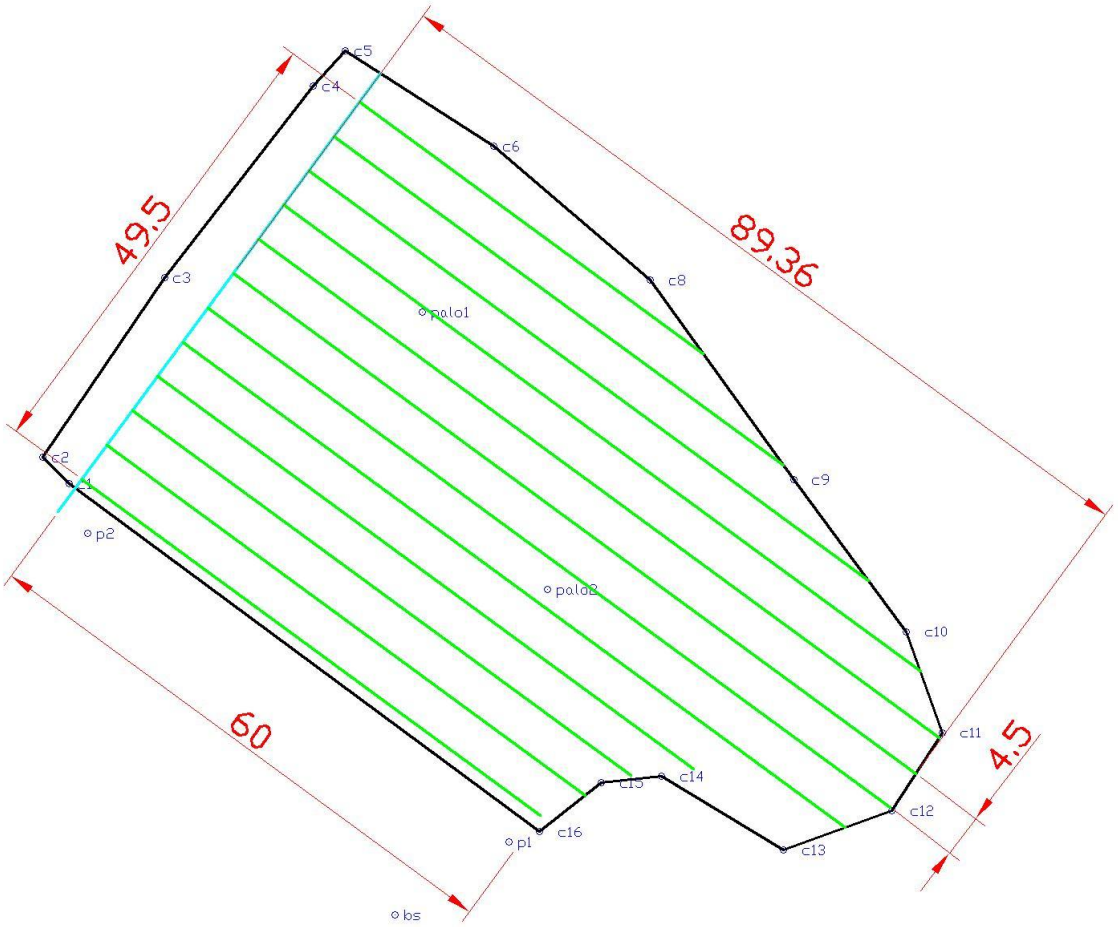
Organic alternatives to soil disinfection in apple replant

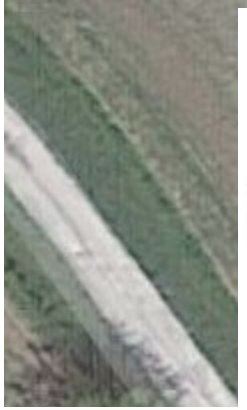
Treatment	microbic C (mg/kg d.m.)
GREEN COMPOST	688,3 (±58,0)
DAZOMET	386,1 (±52,0)
NOT TREATED CONTROL	347,1 (±19,1)

(CRESO 2012)



Modified from Zucconi, 1996





Organic Team UNIVPM

Coordinators DOMINO

Davide Neri, PhD and
Serena Polverigiani, PhD

PhD student
Mia Jebu, MS

Techniciens
Murri Giorgio, PhD

Graduate student
Matteo Zucchini, MS

MS student
Paolo Rita

Apricot orchard installed in February 2018

12 rows 3 X4.5 m spaced (284 plants)

n.1 TOPIC

Selection of local biodiversity toward a higher technical sustainability.

To select the least competitive population by exploiting the **existing diversity** as **resource**.

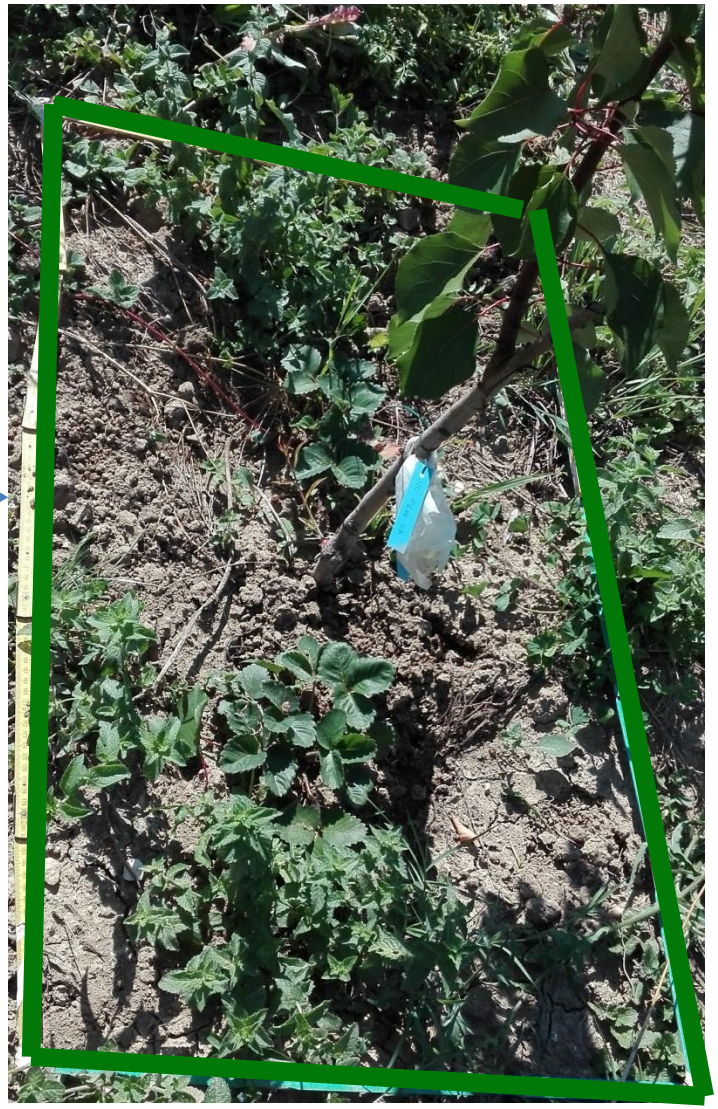
Basic principle

To avoid a **biological vacuum** that would offer an advantage to the most aggressive species

There are commensal species, and …..

… **COMMENSAL** species

Selective manual weeding



50X100 cm frame under each plant

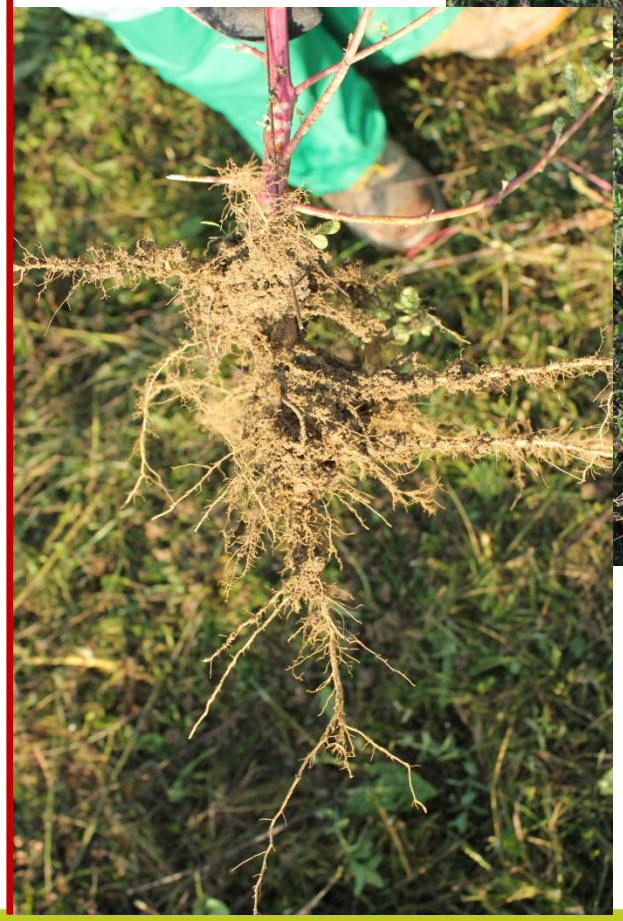
- ✓ To uproot out about 2-4 plantlets per plant
- ✓ Extimated labour of about 8 hours/ha

In June were manually eliminated all..

Pluriennial

Tall and taproot

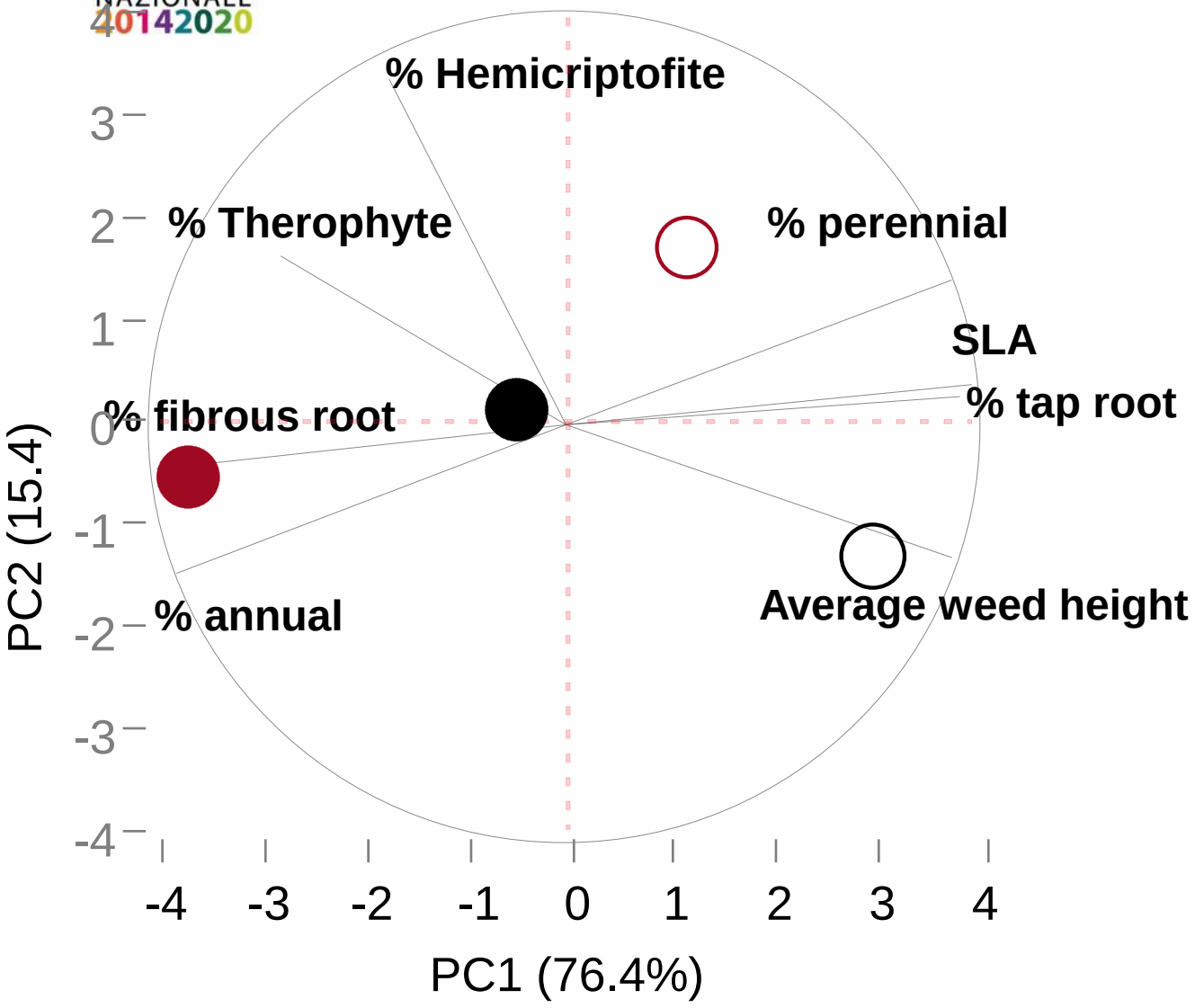
Creepers



Phytosociological survey

(September 2018 and February 2019)

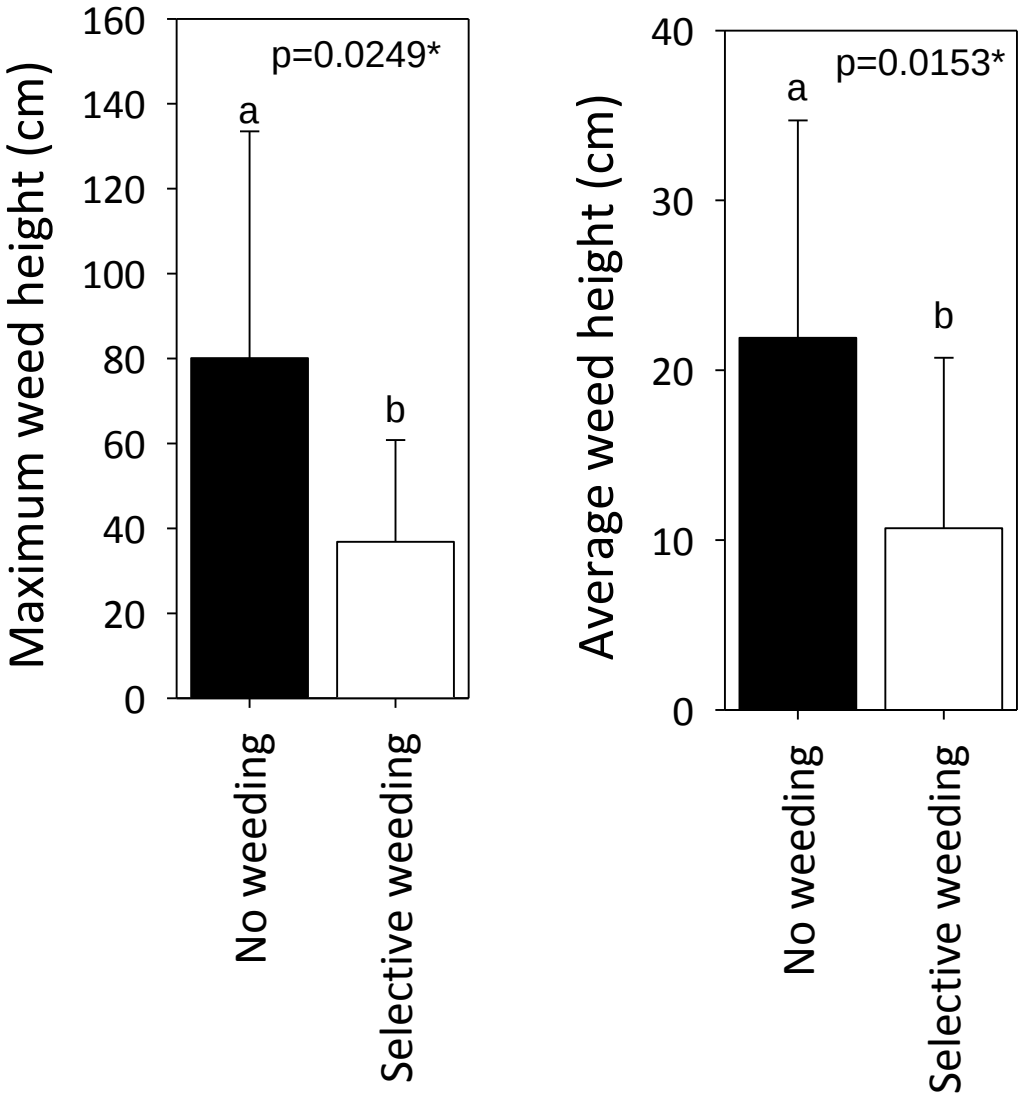
Survey by Prof. Fabio Taffetani full professor of Botany at UNIVPM



2018
2019

No weeding
Selective weeding

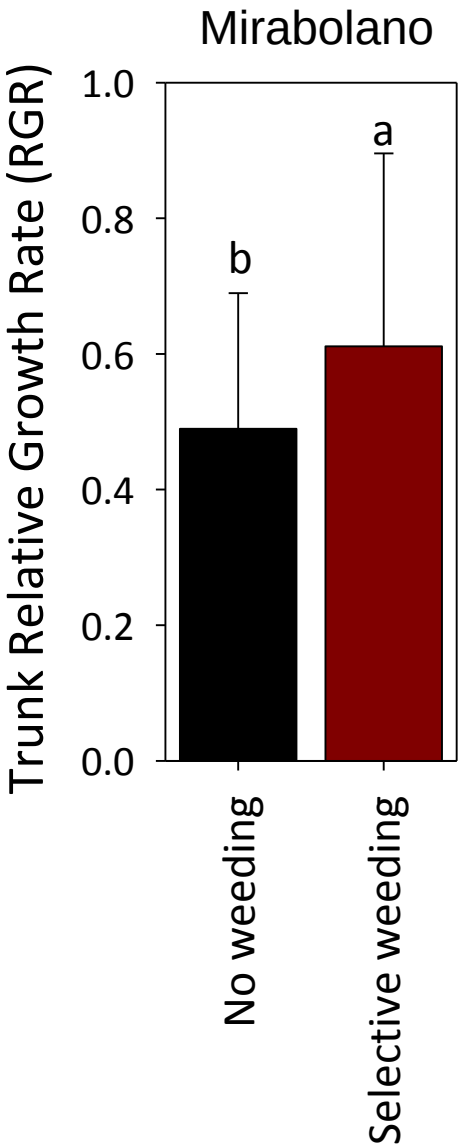
January 2019 (+ 8 months)

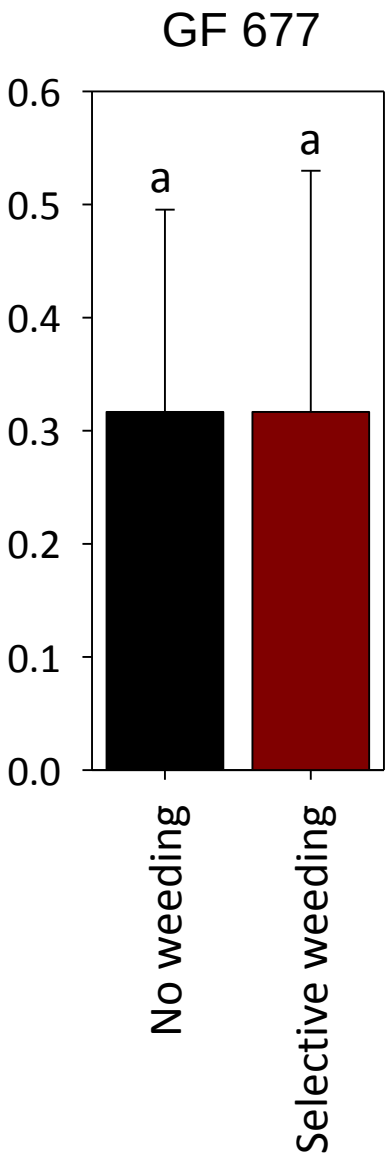


No weeding

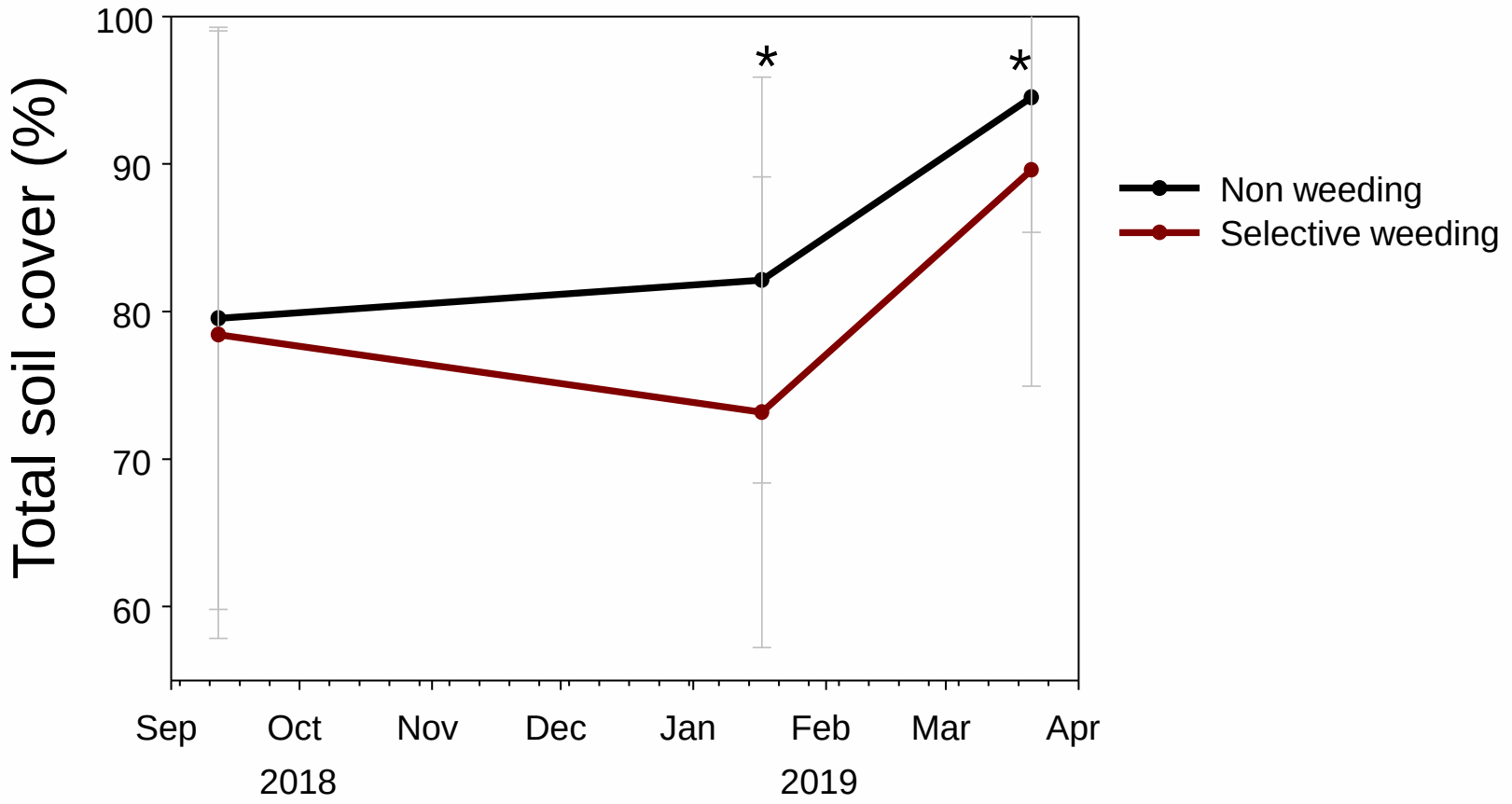
Selective weeding

November 2018 (+ 6 months)



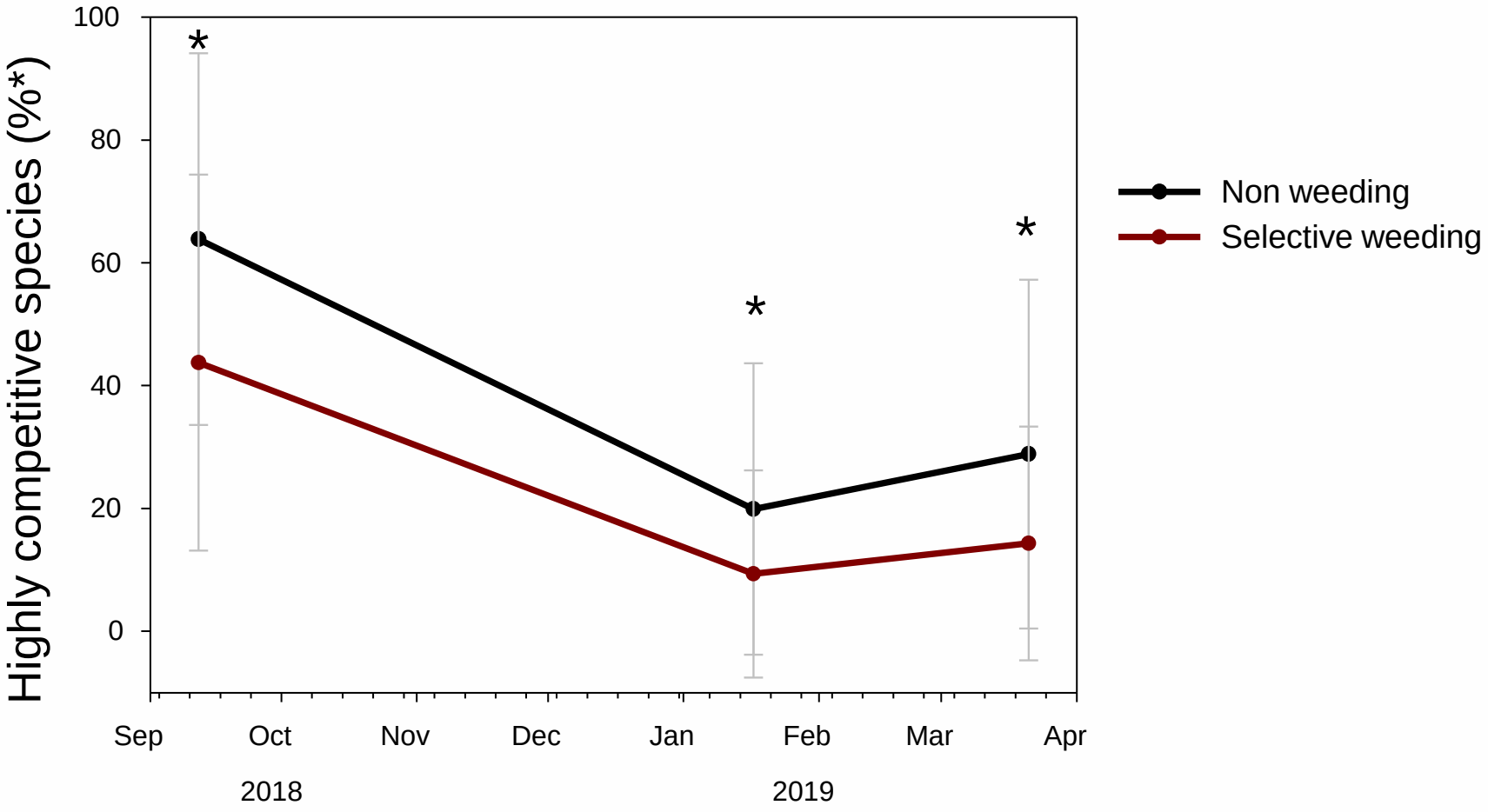


EFFECT ON THE MAIN CROP



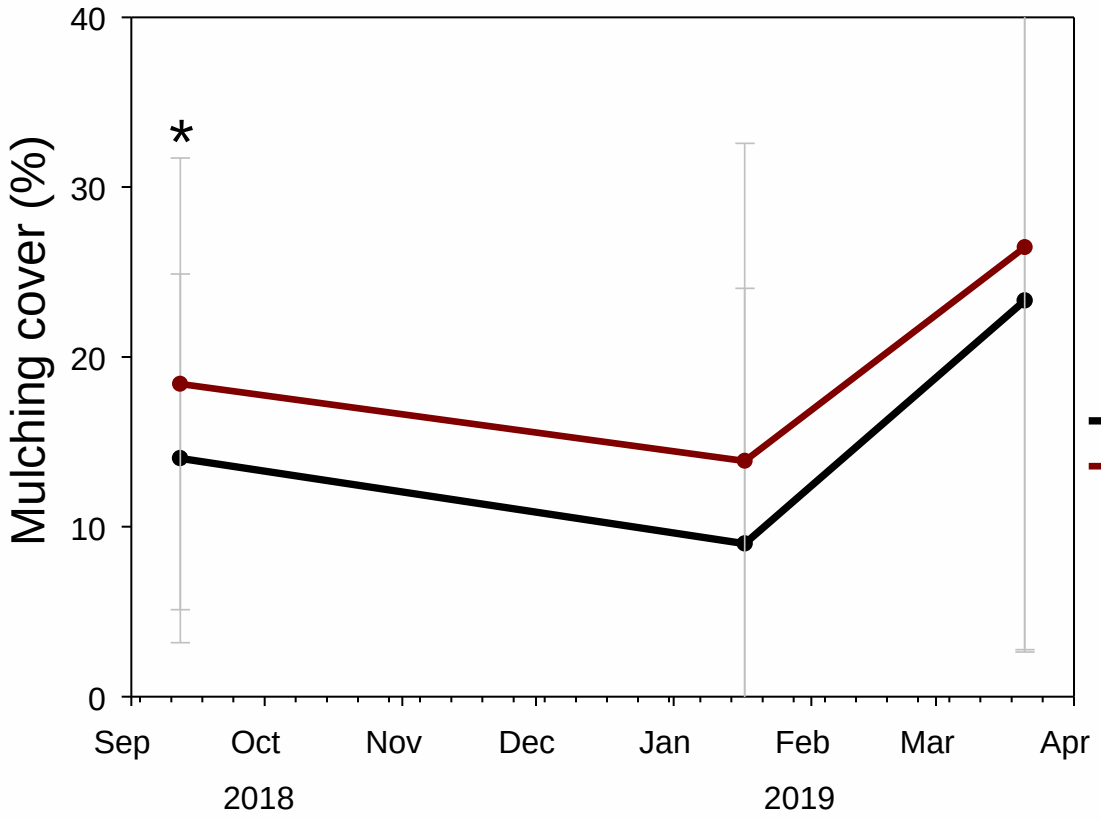
The **lower** incidence of **perennial** species reduced the soil cover during the second winter (not during the first summer)

A reduced incidence of highly competitive species was still appreciable after 10 months



*Relative % on total soil cover

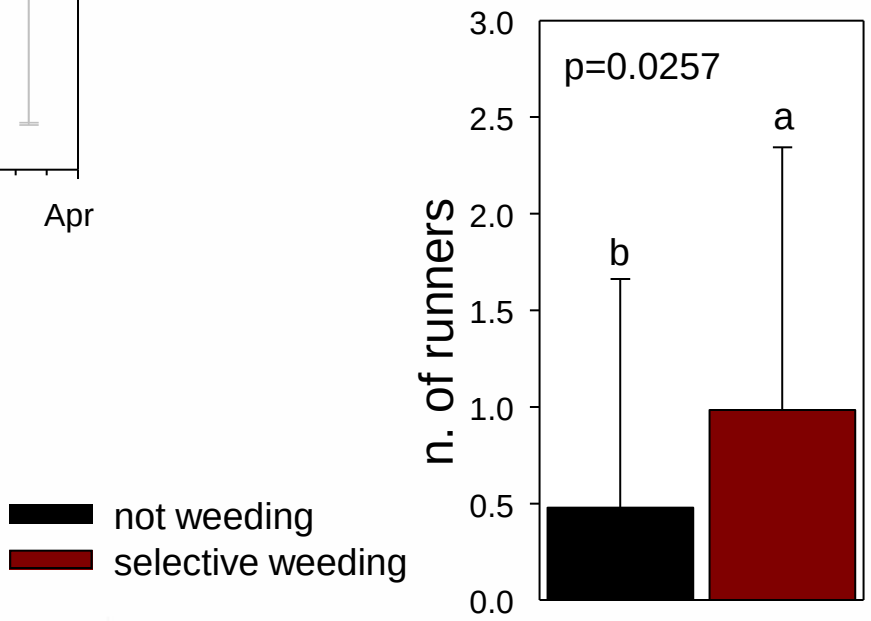
Relative % on total soil cover



…in some of the parcels the grassing was combined with the application of living mulching

Non weeding
Selective weeding

Effect of grassing on mulching performances



not weeding
selective weeding

June 2018

Efficacy of living mulching in controlling soil cover

What species for an effective living mulching?

2nd of May

Superficial tillage of the row and living mulching transplanting

…after 1 month

Pink strawberry

Fragaria X Ananassa octoploid

Strawberry of Sibillini mountains

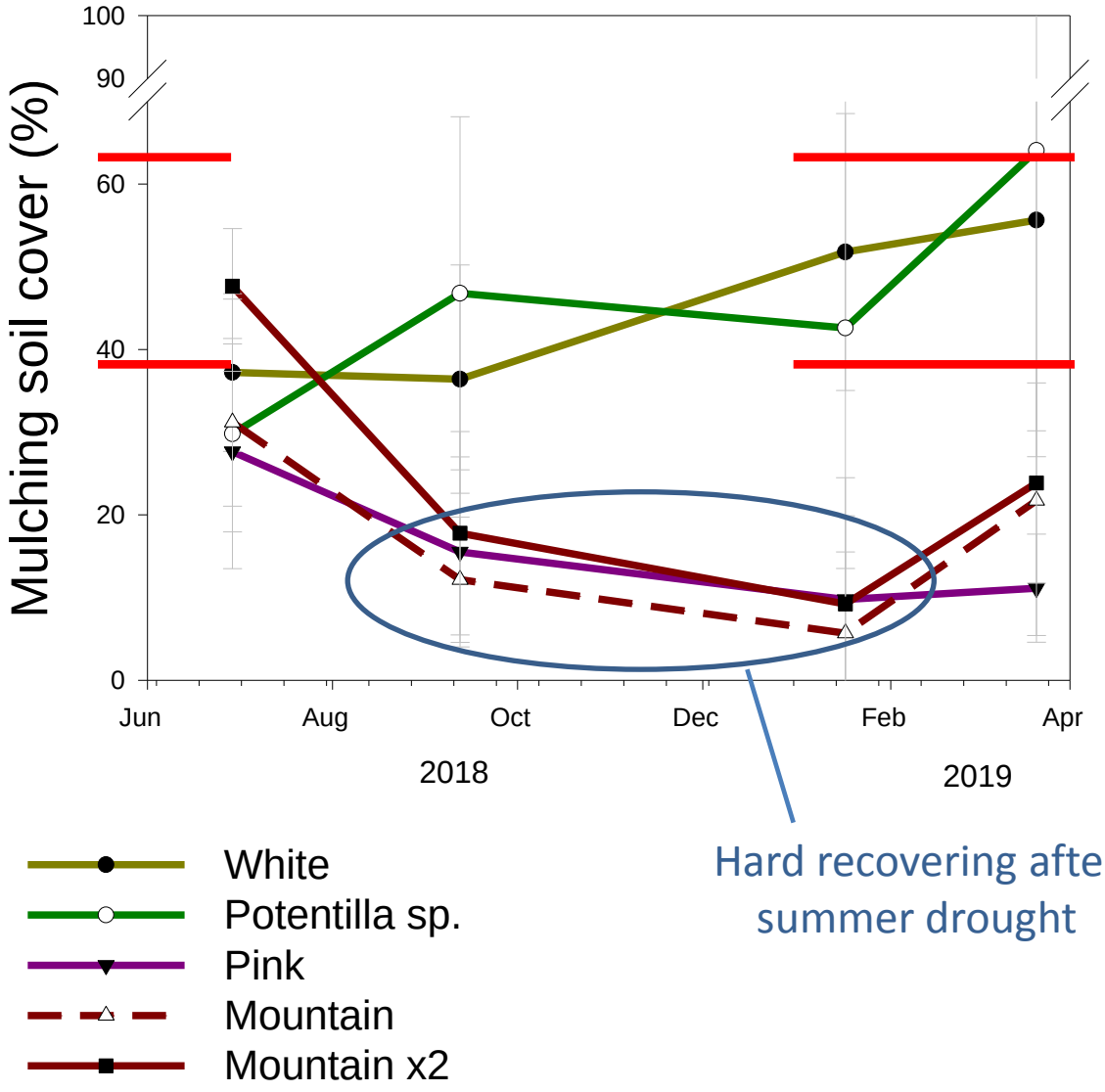
Fragaria vesca diploid

Potentilla spp.

White strawberry

Fragaria vesca diploid

Mulching species performances



Jannuary 2019: whide soil cover during winter

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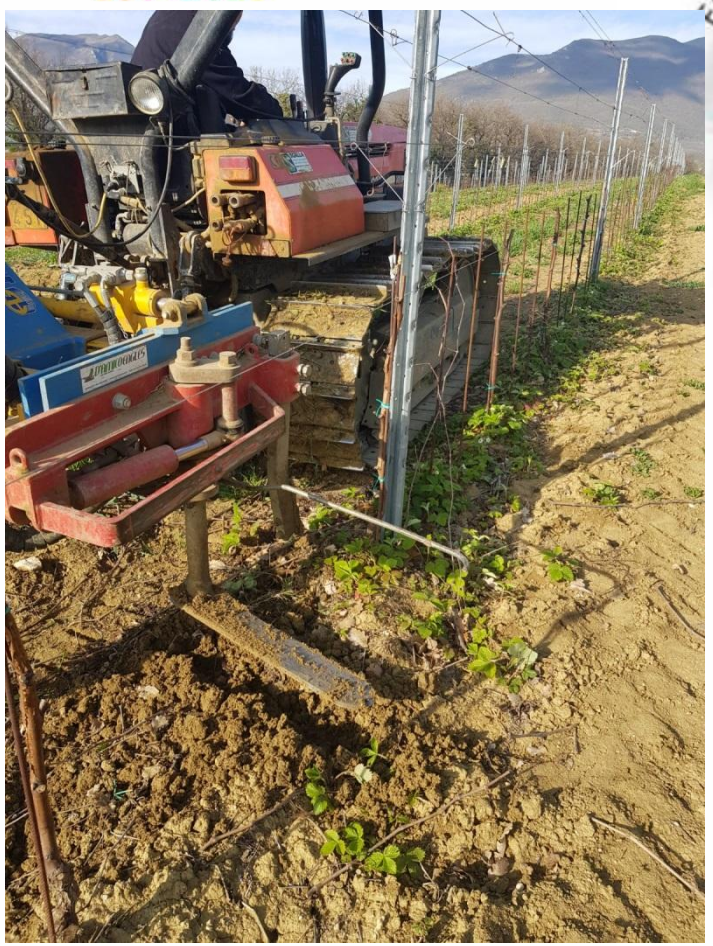
Hilly areas exposed to soil erosion

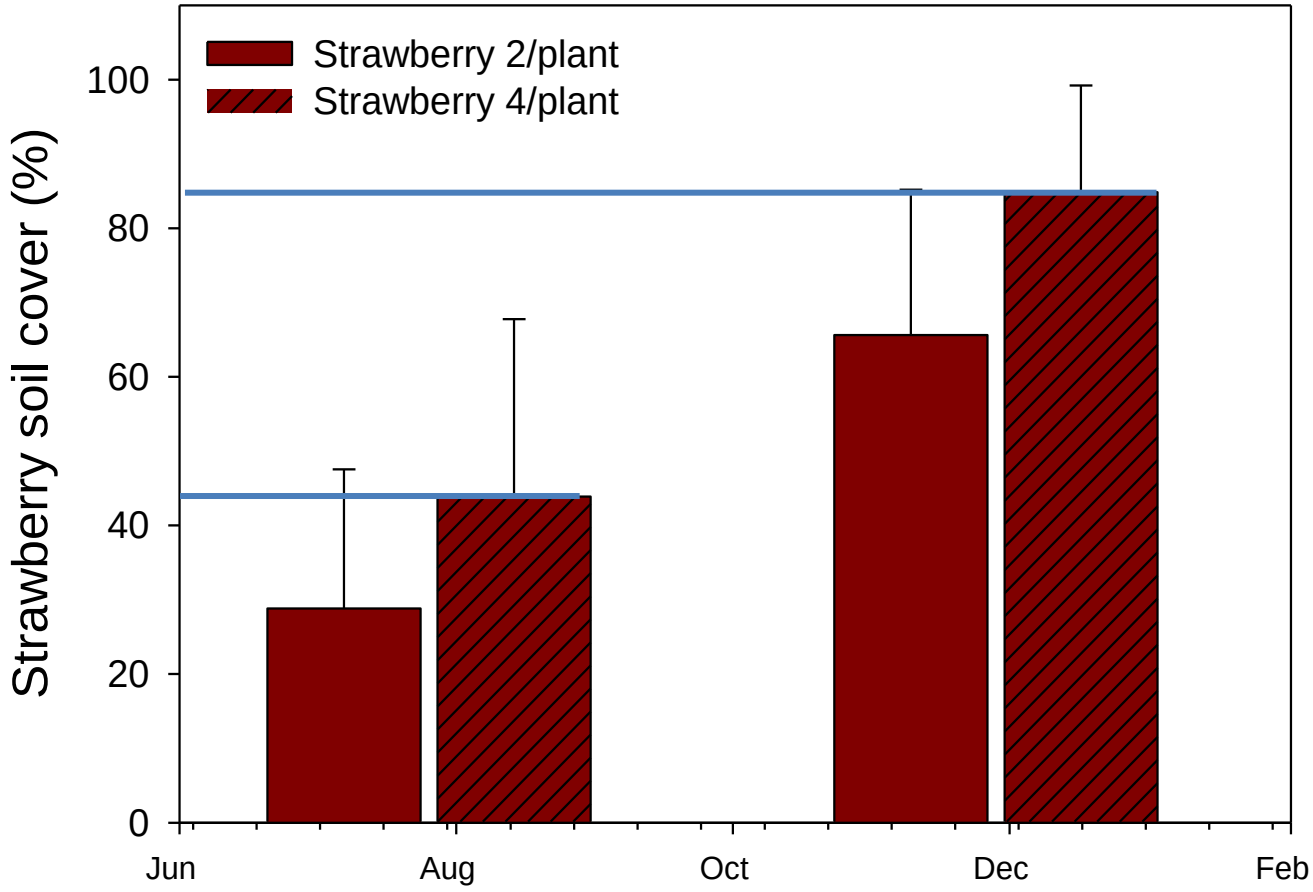
Picking the better mechanization technique by the partecipative approach

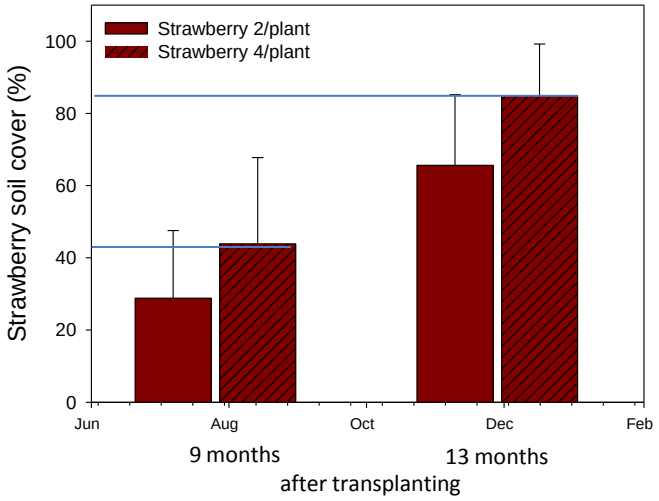
Great opportunities from stakeholder's feedbacks

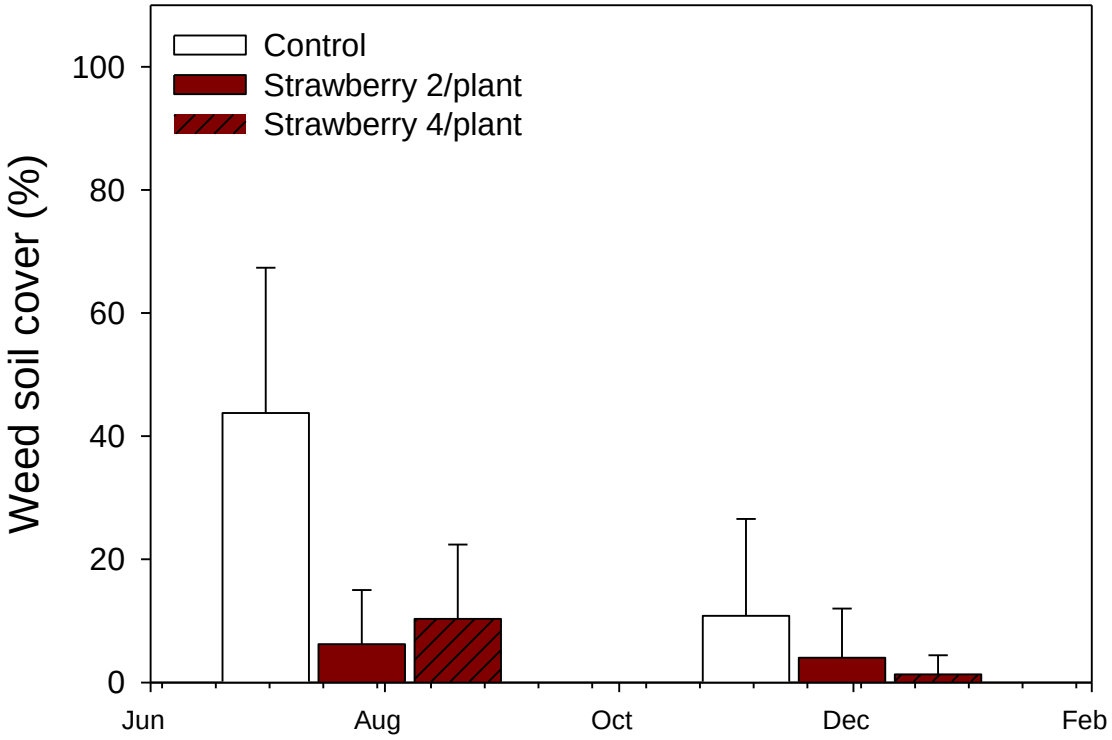


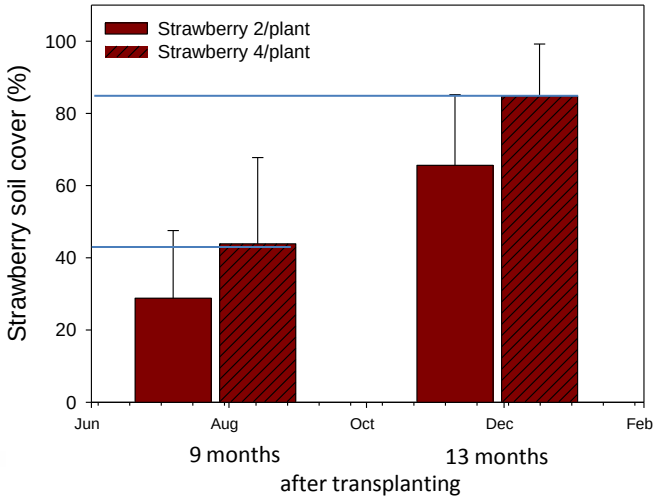
Selection at root level

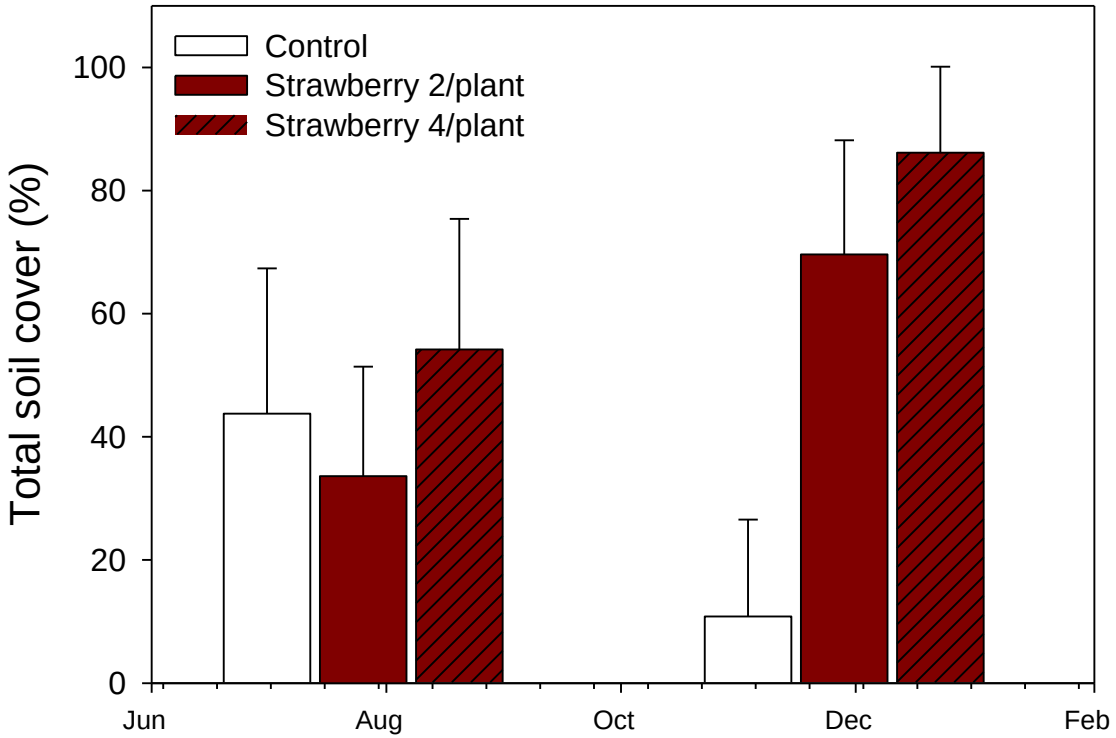
Quick development of the canopy and large production of runners




Strawberry 2/plant
Strawberry 4/plant
Strawberry soil cover (%)
100
80
60
40
20
0
Jun
Aug
Oct
Dec
Feb
9 months
13 months
after transplanting


Control
Strawberry 2/plant
Strawberry 4/plant
Weed soil cover (%)
100
80
60
40
20
0
Jun
Aug
Oct
Dec
Feb





Soil fully covered over the winter

The owner remarked:

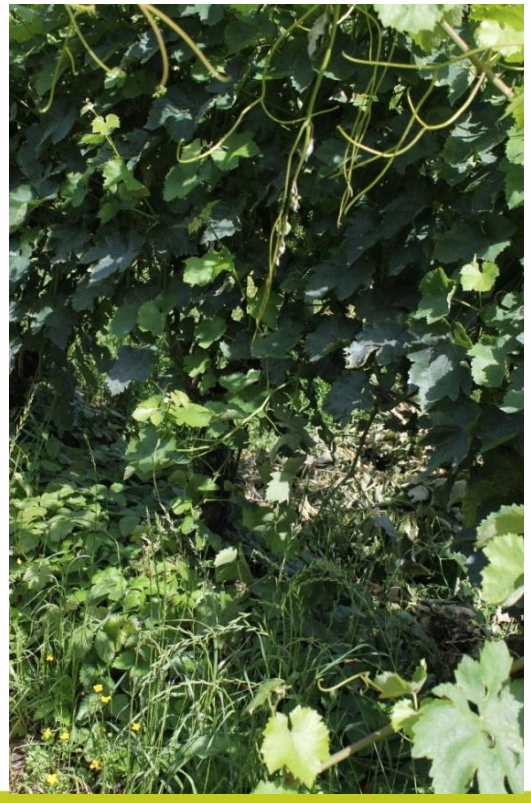
- ✓ The technical is helpful especially in the management of the area surrounding the trunk harder to manage otherwise.
- ✓ All the tap root weeds were affected by the laboring with blade.
- ✓ Absolutely no damages on strawberries when the labor is done with fresh, moist soil.
- ✓ The blade itself contributed in shifting the plants, thus helping soil colonization.

- ✓ Great compatibility of the labor required with the other activities scheduled.

WEAK POINT

Suitable just in a soil managementstrategy that requires frequent soil labor to avoid compaction.

Hardly succesfull in the presence of a previous grass cover.



Extimated labour of about 30 hours/ha:

Thus includes a manual soil labor that would have been necesary in the 1°-2° and 3° year in any case

The presence of strawberry avoid other manual weeding in the 2° and 3° years.

No costs for the trawberry plantlet: harvested from the same wineyard

Fruit production for direct selling/short supply chain

Az. Agr. Madonna delle Api, Osimo (AN)

Lorenzo

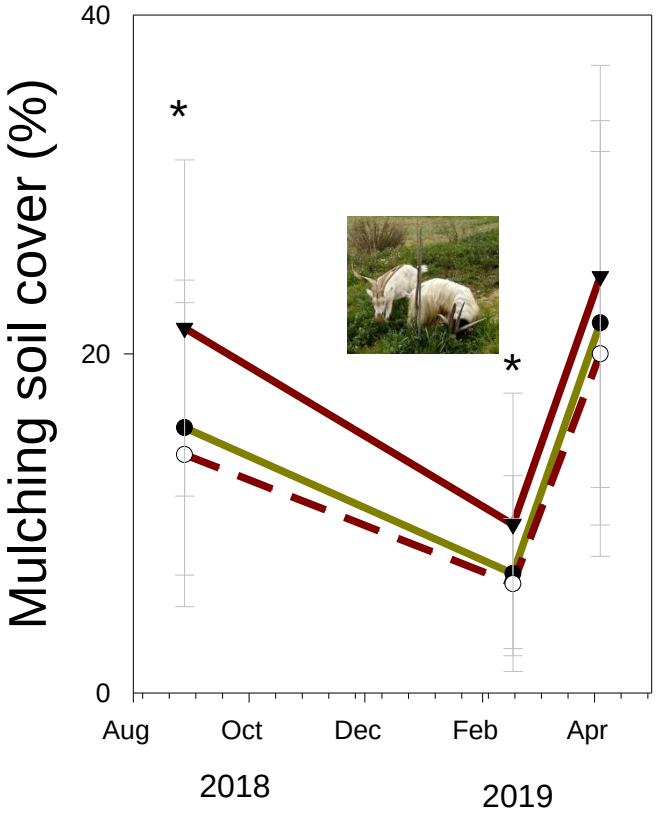
Row grassing management replaced by goat grazing

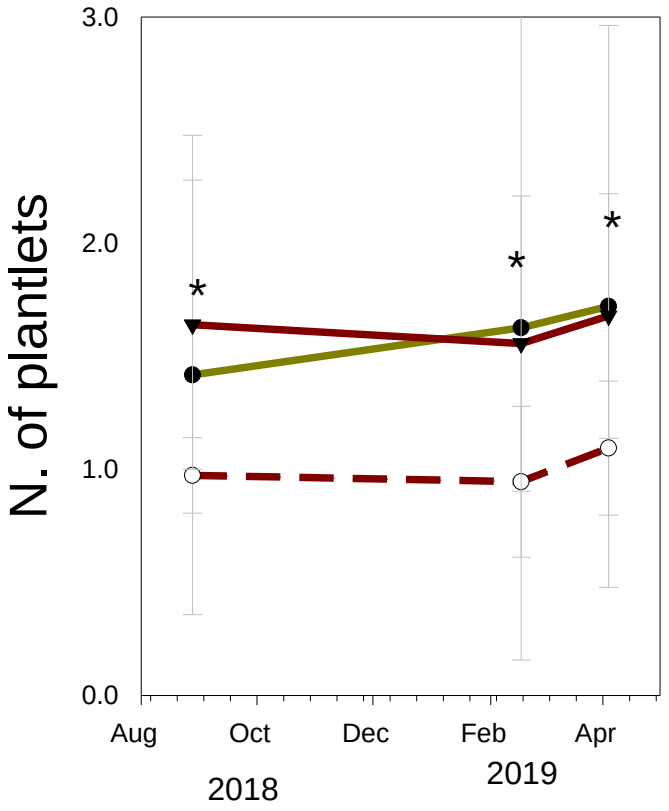
Transplanted
in April 2018

Grazed
during winter

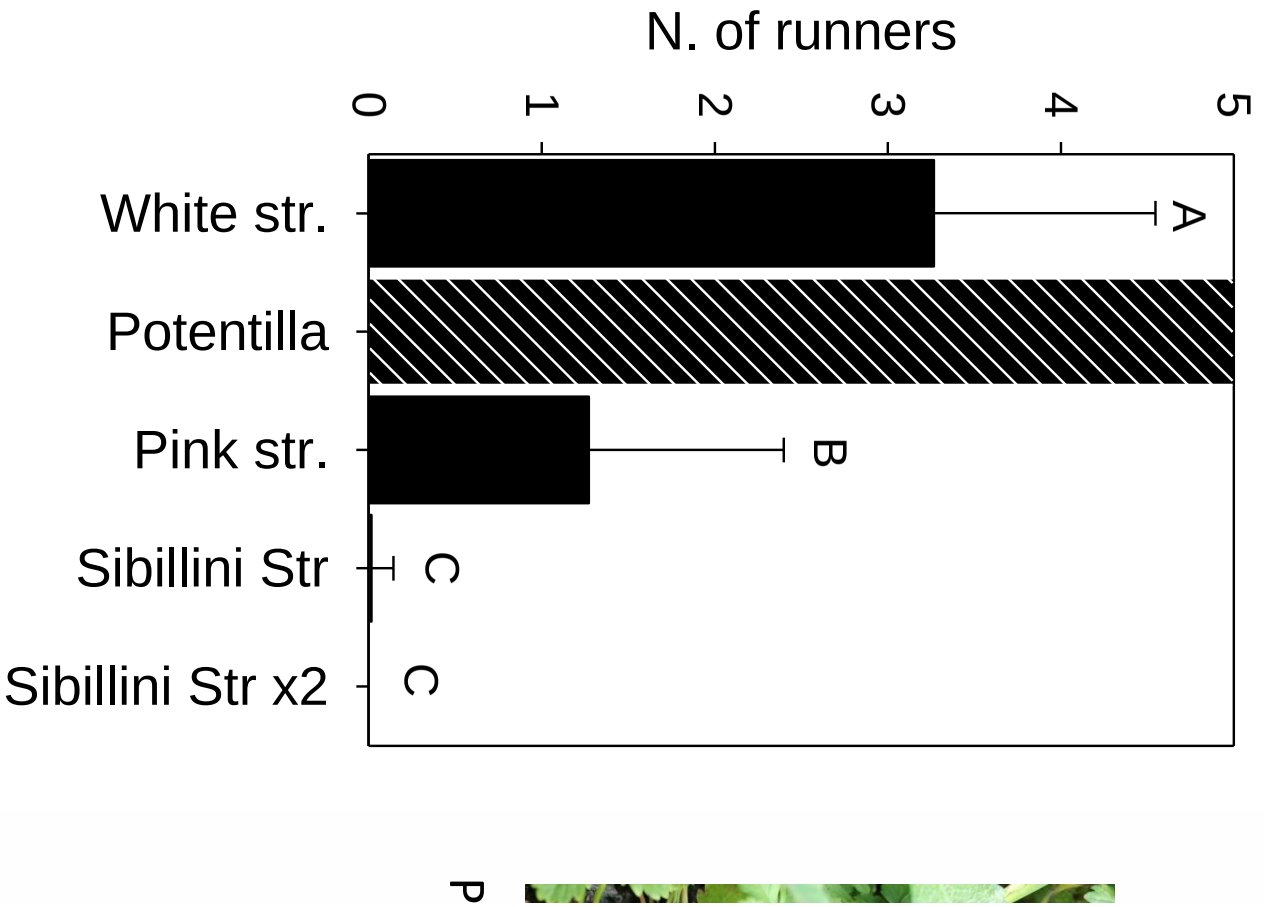
Selection at canopy level

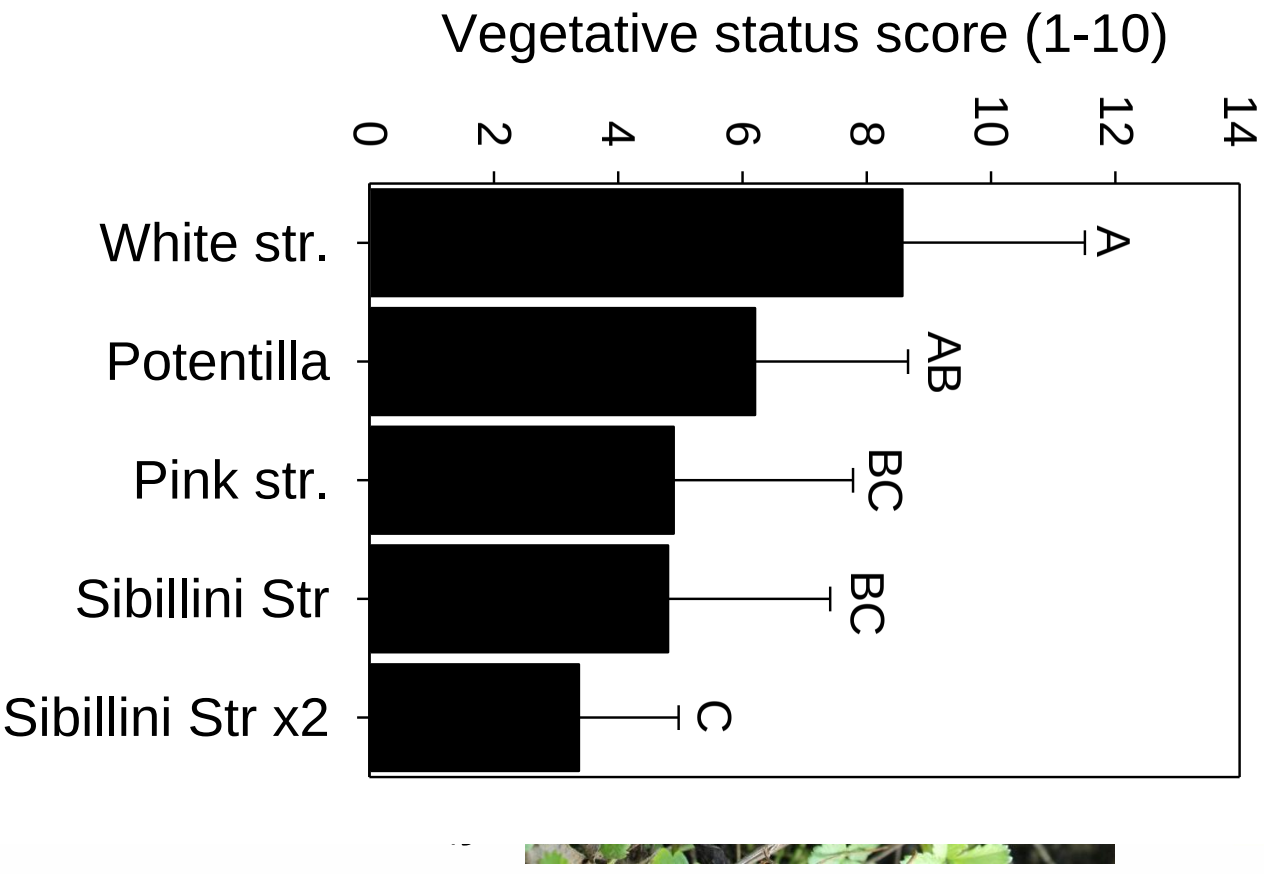
Several plantlets, from runners, survived the grazing and developed from late winter (with about no competition).





White
Mountain
Mountain x2


N. of runners
0
1
2
3
4
5
White str.
Potentilla
Pink str.
Sibillini Str
Sibillini Str x2
A
B
C
C


Vegetative status score (1-10)
0
2
4
6
8
10
12
14
White str.
Potentilla
Pink str.
Sibillini Str
Sibillini Str x2
A
AB
BC
BC
C

Preliminary conclusion

- to valorize local biodiversity for a sustainable soil cover.
- Living mulching could be a successful strategy but species and timing really matter.

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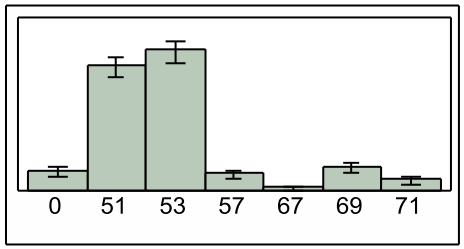
1° treatment with Cu
4 of March

The phenological stage of all strawberries (according to BBCH scale) ranged from 00 to 12.



Frequencies

Level	Count	Prob
0	15	0.05639
51	99	0.37218
53	111	0.41729
57	13	0.04887
67	2	0.00752
69	18	0.06767
71	8	0.03008
Total	266	1.00000

N Missing 2588

7 Levels

Principal growth stage 0: Sprouting/Bud development

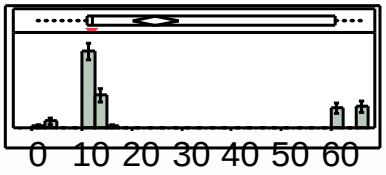
00	Dormancy: Leaves prostrate and partly dead
03	Main bud swelling

Principal growth stage 1: Leaf development

10	First leaf emerging
11	First leaf unfolded
12	2nd leaf unfolded
13	3rd leaf unfolded'
1 .	Stages continuous till . . .
19	9 or more leaves unfolded

Strawberry phenological stage (BBCH)

21 March

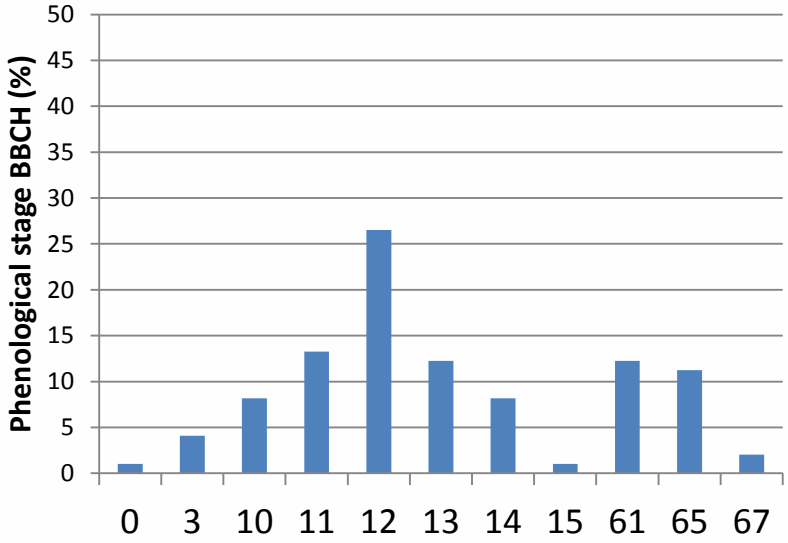


100.0% maximum 67
99.5%
97.5%
90.0% quartile
75.0% median
50.0%
25.0% quartile
10.0%
2.5%
0.5%
0.0% minimum

Quantiles

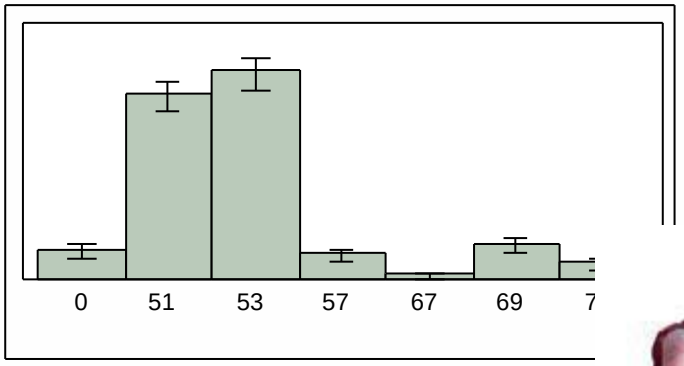
Moments

66.05		Mean	24.602041
		Std Dev	22.813651
		Std Err Mean	2.312876
		Upper 95% Mean	29.188849
		Lower 95% Mean	20.015559
		N	98

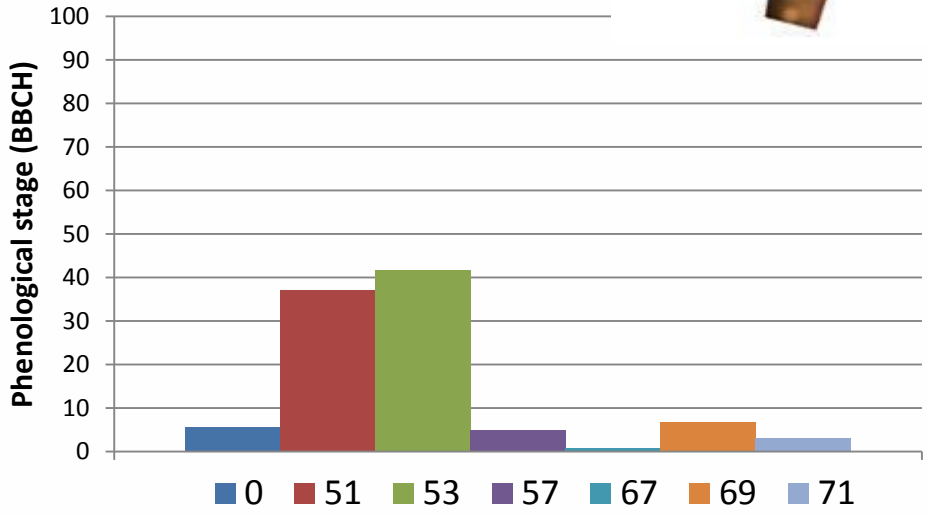


Principal growth stage 6: Flowering

60	First flowers open (primary or A-flower)
61	Beginning of flowering: about 10% of flowers open
65	Full flowering: secondary (B) and tertiary (C) flowers open, first petals falling
67	Flowers fading: majority of petals fallen



Level	Count	Percentage
0	15	5.6
51	99	37.2
53	111	41.7
57	13	4.9
	2	0.8
	18	6.8
	8	3.0
	266	



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Thanks for your attention!

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