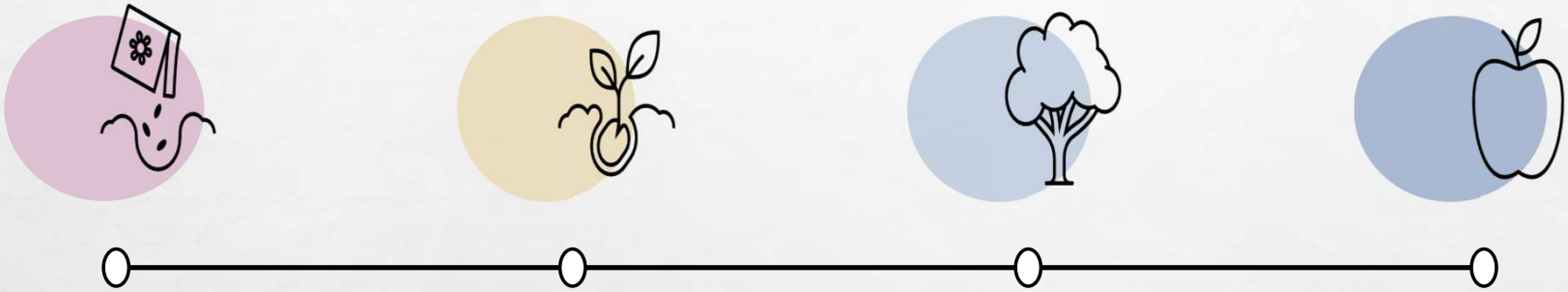
Improving soil health with cover crops: biodiversity indicators



- STARTING POINT
- PROBLEMS
- CHALLENGES AND OPPORTUNITIES
- SOLUTIONS
- RESULTS

SOIL LIFE FIRST

Melhoria da saúde do solo por culturas de cobertura: indicadores de biodiversidade em estudo

Jlf Luz - Sociedade Agro-pecuária, Lda
Sociedade Agrícola Herdade das Malhadinhas
Rumiagro Sociedade Unipessoal, Lda

PRR Plano de Recuperação e Resiliência
REPÚBLICA PORTUGUESA
Financiado pela União Europeia NextGenerationEU

- STARTING POINT
- PROBLEMS

Plant protection problems (pest & diseases)

Weeds

Soil erosion and compaction

Biodiversity loss

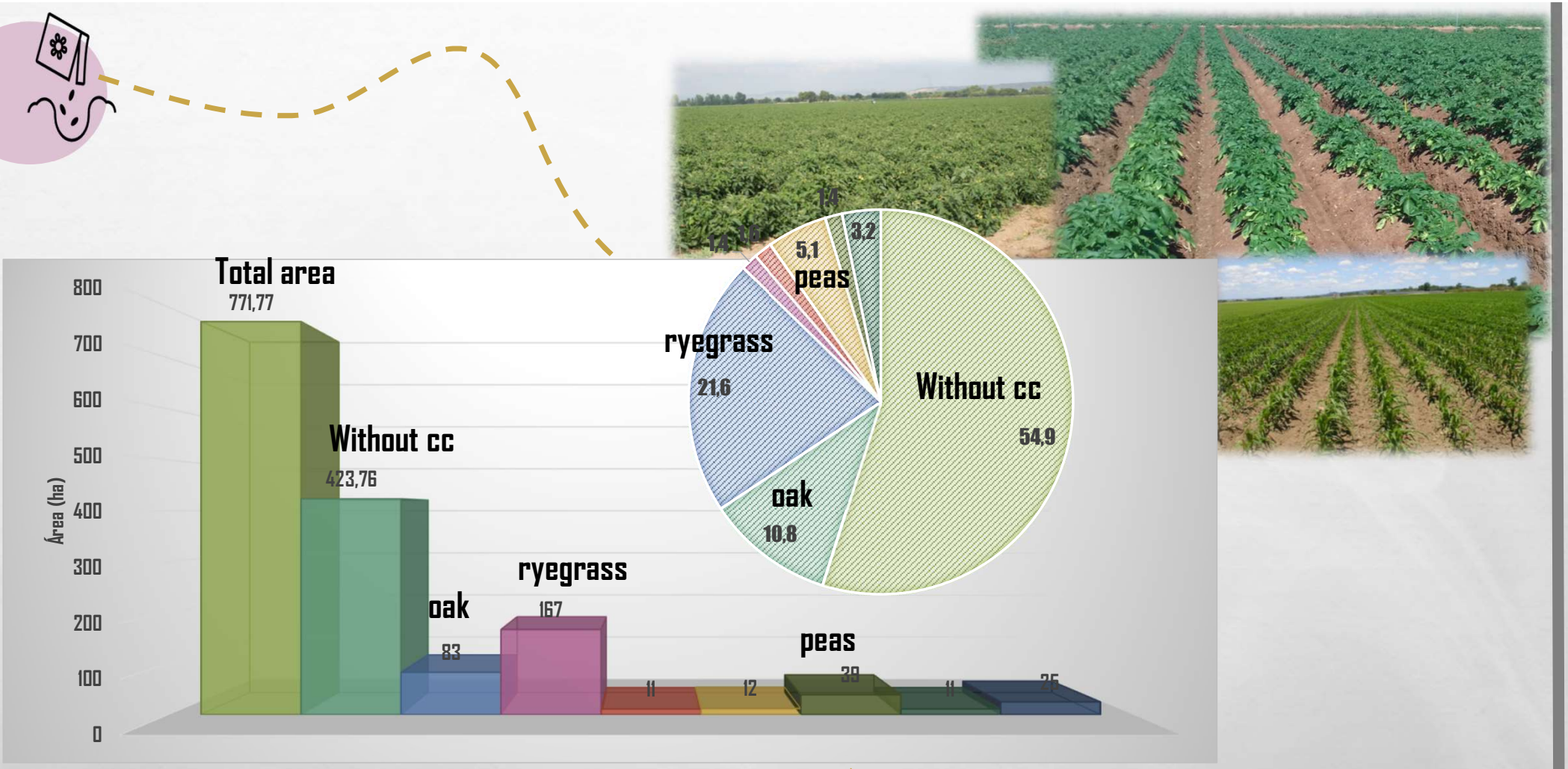
(...)

maiSolo

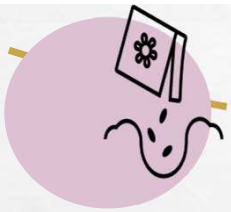
Horticover

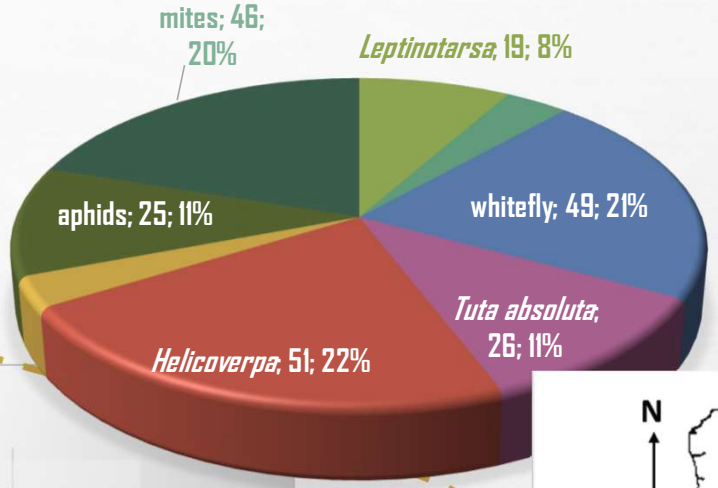
SOIL LIFE FIRST

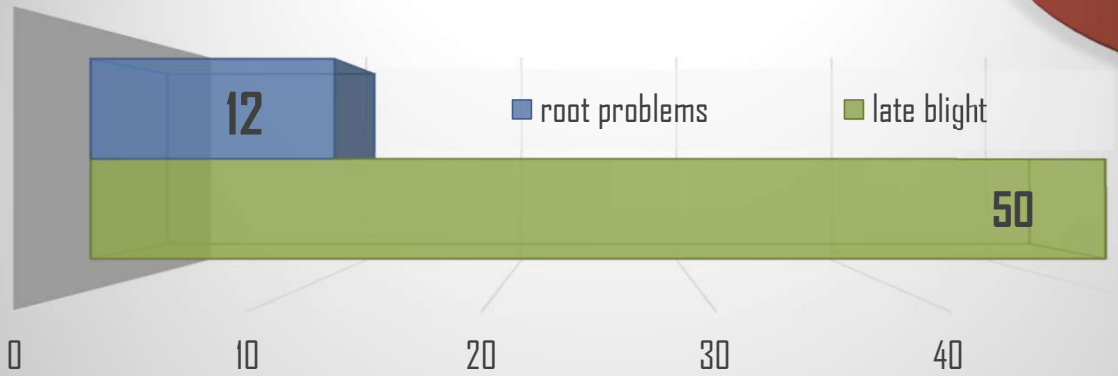
2016 — 2020 — 2022 — 2025



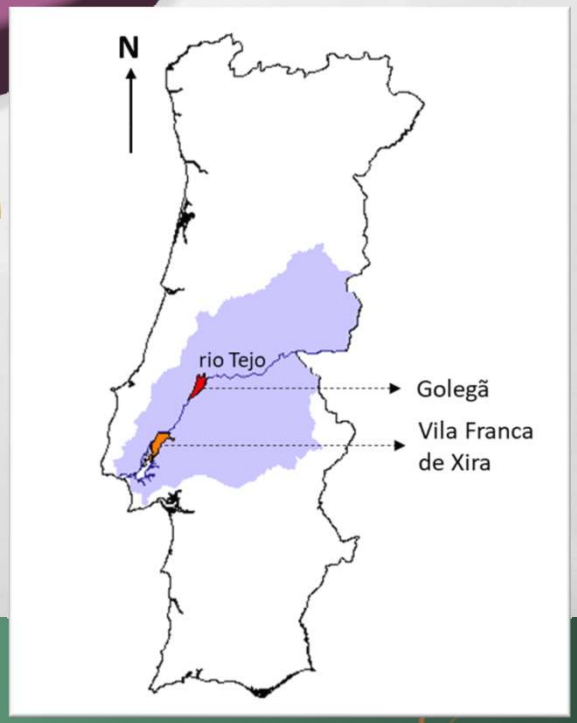
Source: survey GO MaiSolo 2018



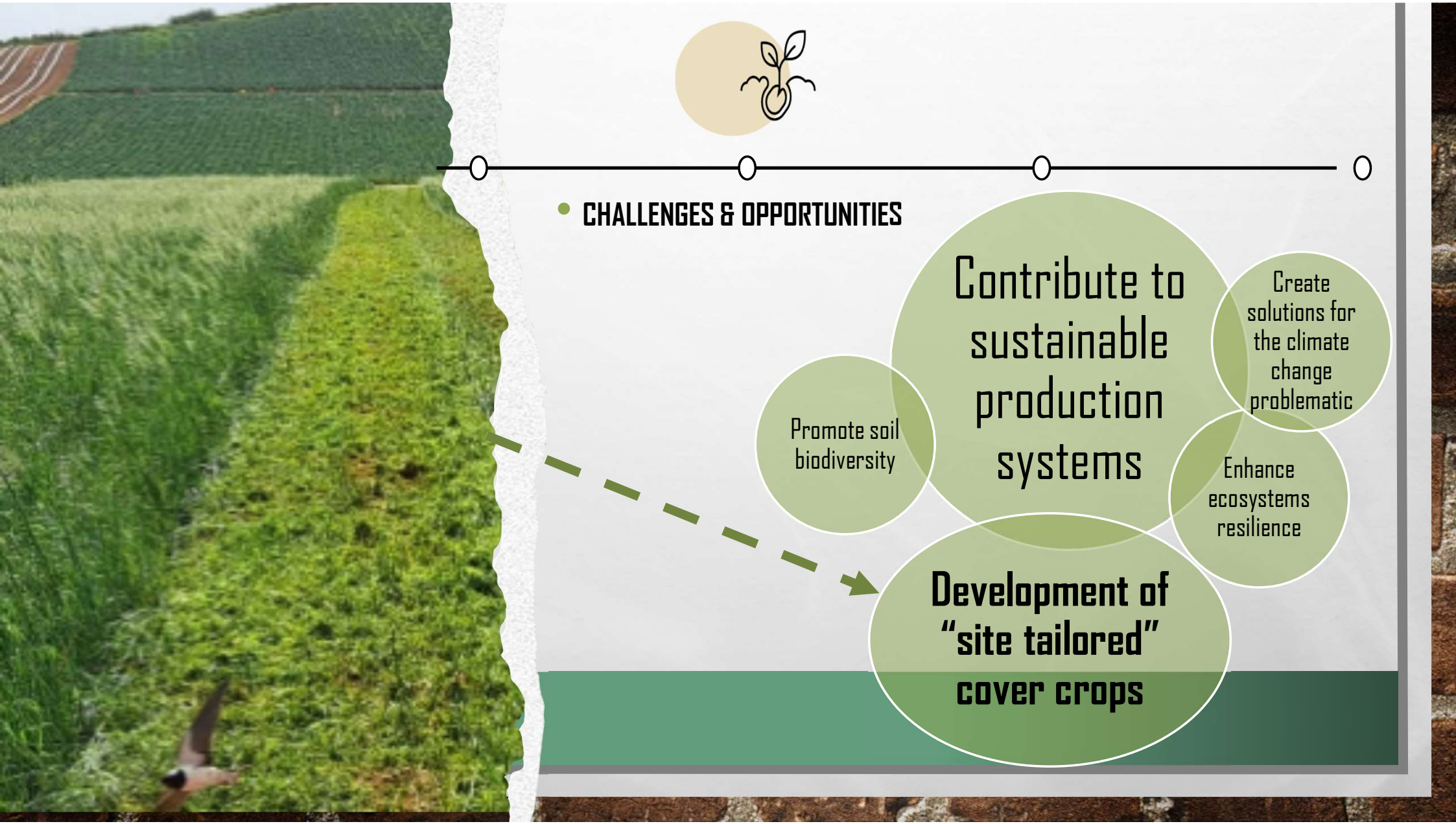




Number of farmers that refer as a main problem



Source: survey GO MaiSolo 2018


CHALLENGES & OPPORTUNITIES
Contribute to sustainable production systems
Promote soil biodiversity
Create solutions for the climate change problematic
Enhance ecosystems resilience
Development of "site tailored" cover crops

SOLUTIONS

Living lab points

GOLEGÃ SJB

2CC

ANIMAL FEED AND GREEN MANURE

RAPOSA RUMIAGRO

2CC

ANIMAL FEED

GOLEGÃ CASAL FREIRAS

1CC

ANIMAL FEED AND GREEN MANURE

TVEDRAS EMERGOSOL

1CC

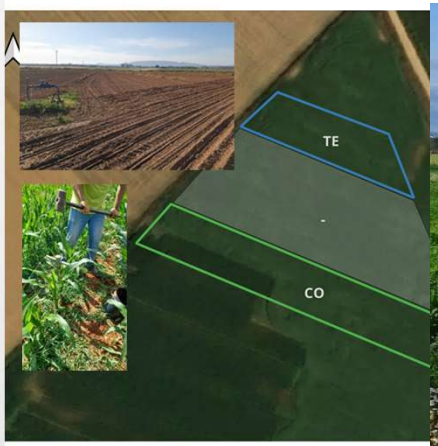
GREEN MANURE

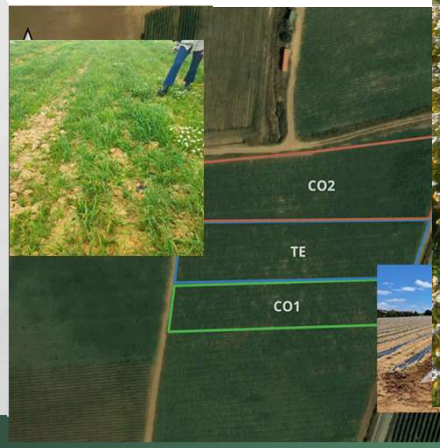
BREJÃO CAMPOTEC

3CC

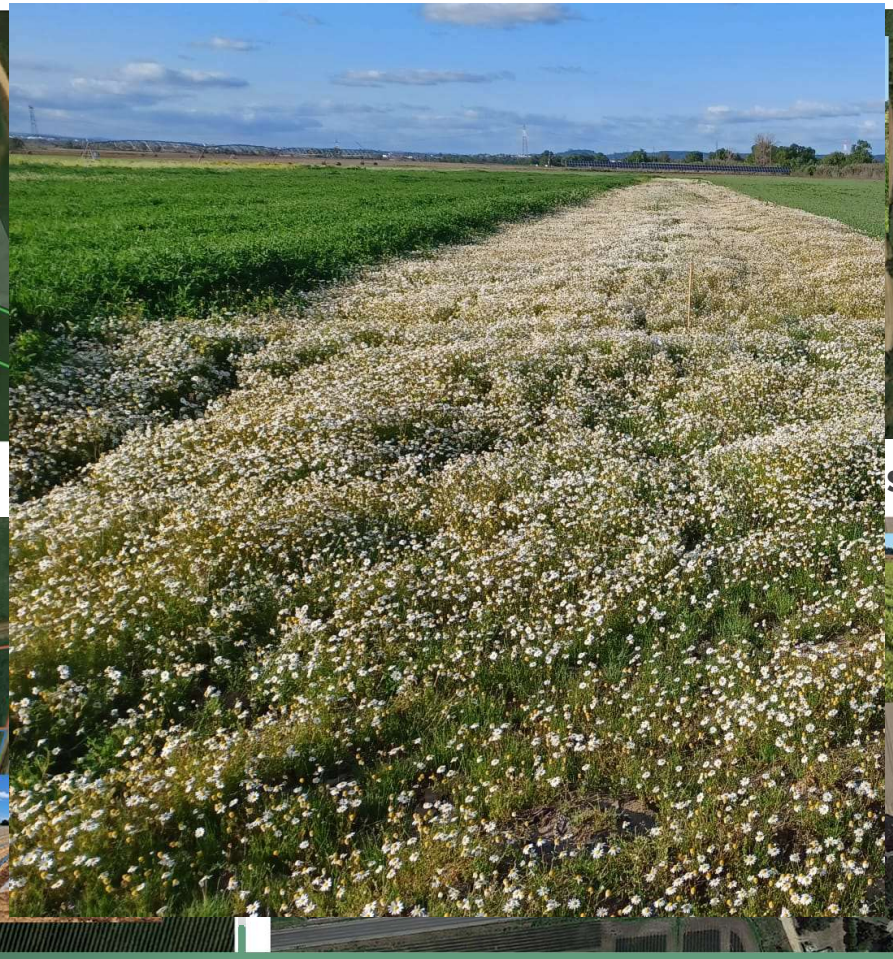
GREEN MANURE CRUCIFERAE & PERMANENT COVER IN THE IRRIGATION LINE

Casal das Freiras





São João de Brito



Raposa

Why measure biodiversity in the soil?

Because it's "soil life" that ensures functions like the decomposition of OM; conversion, mobilization and easy absorption of nutrients by plants; Stabilization of soil aggregates and improvement of soil structure...

Because arthropods facilitate the degradation of organic matter and protect plants against pests and diseases, among other functions...

Because atmospherical nitrogen is fixed by root nodule bacteria and provided to host plants

Because there is improved absorption of nutrients by associations between plants and fungi - mycorrhizae

(...)

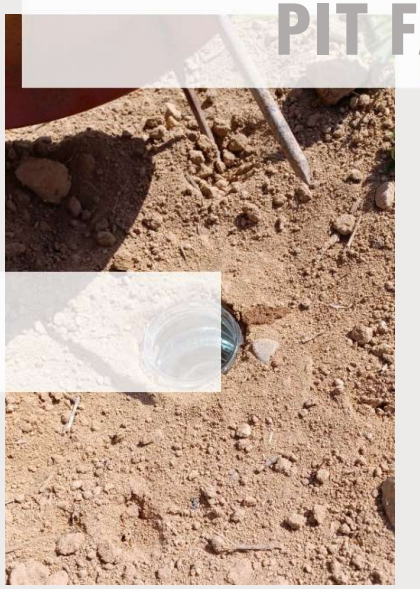
Knowing the state of the soil regarding its living component, gives us information about its productive capacity

Bioindicators: case study

SoiLife1st

PIT FALL

field



lab

QBS - ar

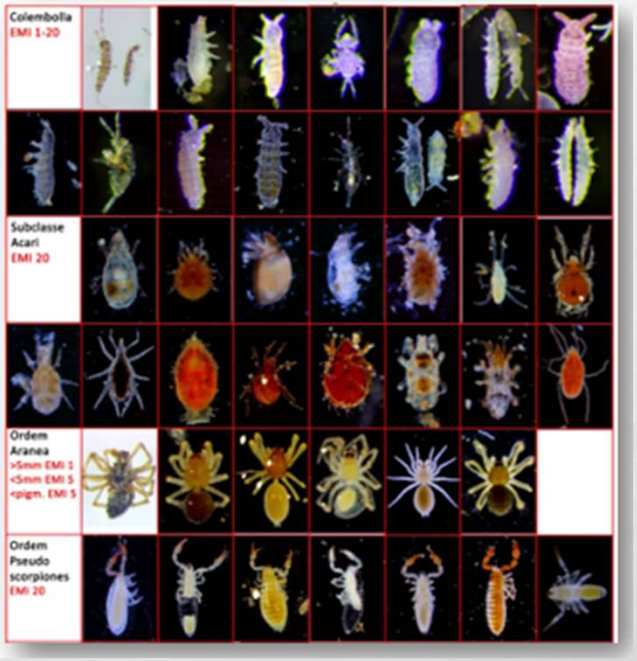
field

lab

Soil Probe

Soil Sampling

Soil Collecting







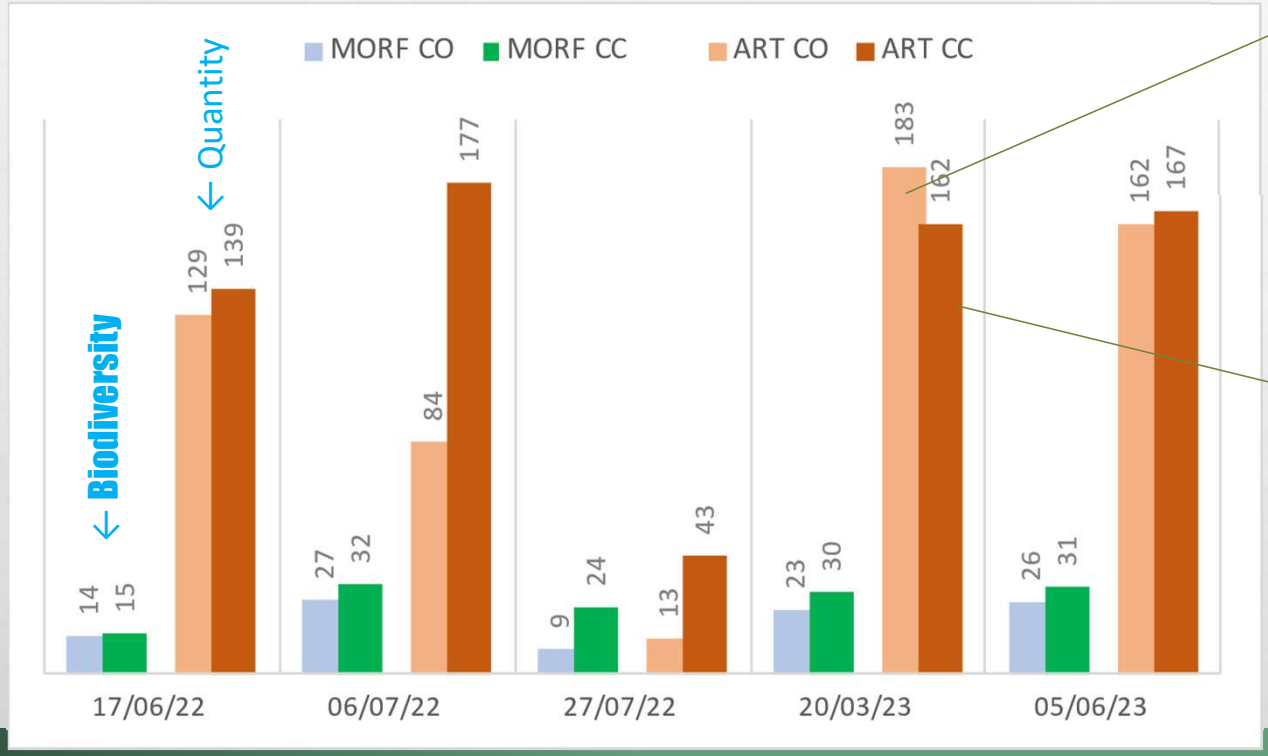


Ilustration by Henrique Santos

Staphylinidae	Carabidae	Arachnida: Opiliones	Collembola	Acari
The majority of staphylinids are generalist predators of pests recognized as important components of agroecosystems by the biological protection function	Mostly consisting of species with predatory habits. Important presence in habitats and areas of known sensitivity to changes and the function as beneficials	They are arachnids with large eating habits. They can predate on pests and can be decompositors aiding in nutrient recycling	One of its functions is to regulate fungi populations, interfering in their dispersion and having a positive role in the relationships of mycorrhizae and in the control of soil microbial communities. Most soil predatory organisms feed on collembola, and many species of coleoptera, hymenoptera and many predatory mites have specialized in their predation, being key elements in the food chains.	They are one of the most abundant groups of soil invertebrates. They influence the decomposition of organic matter and the dynamics of nutrients. They can be predators and are abundant in disturbed areas because they have a high reproductive potential

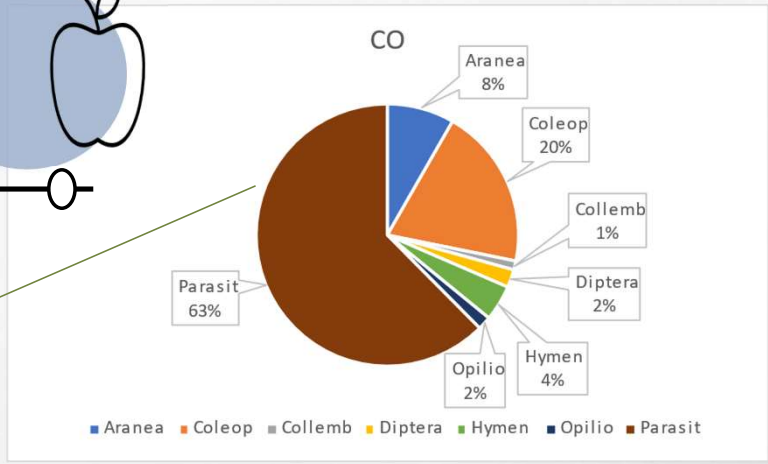
RESULTS

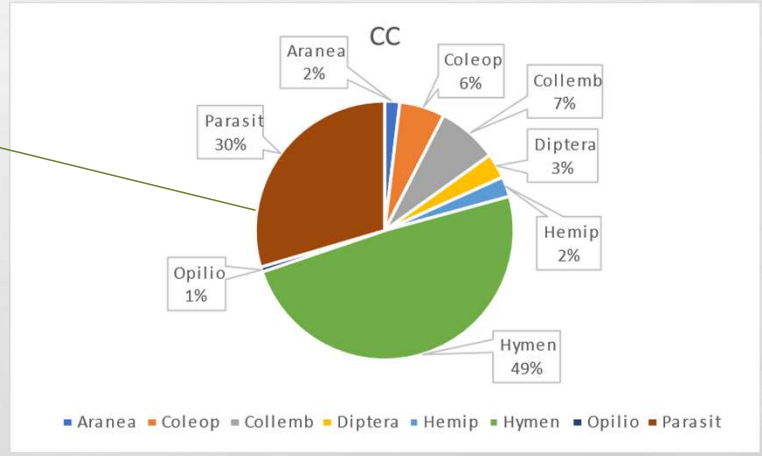
ARTHROPODS DIVERSITY



Total number of Arthropods [ART] and morphotypes [MORF] by sampling period and plot (Control [CO]; cover crop [CC]).

Chamusca 2022 e 2023





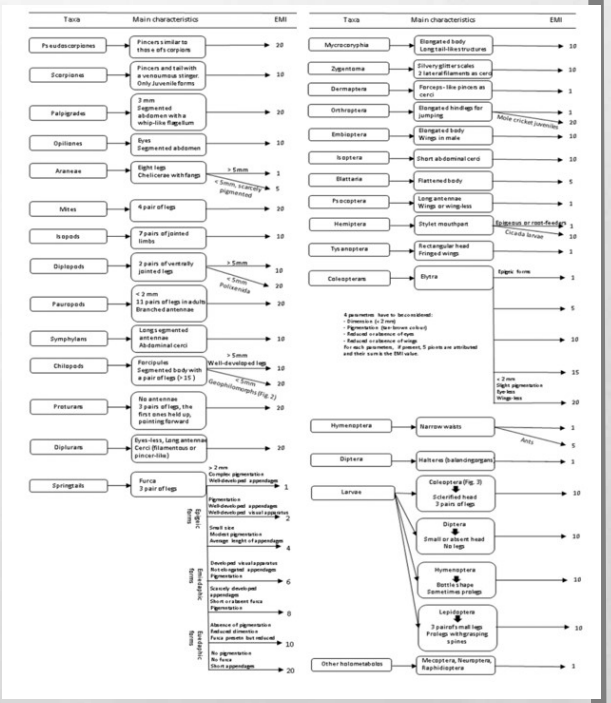
Arthropod distribution by taxonomic order, in the sampling period of 20/03/2023: a) control plot [CO], b) cover crop plot [CC].

ARTHROPODS DIVERSITY: QBS - ar

RESULTS

EMI values and QBS-ar indexes by sampling periods.

	2022								2023					
	Cover Crop		Main Crop						Cover Crop		Main Crop			
	16/02		17/06		06/07		27/07		01/02		05/06		24/07	
	CC	CO	CC	CO	CC	CO	CC	CO	CC	CO	CC	CO	CC	CO
Acari	20	20	20	20	20		20		20	20	20	20	20	20
Araneae		5												
Collembola	10	2	10	4	10		10	10	10	8	20	10	20	10
Coleoptera	5				5	10	1							
Diptera			1	1	1	1	1	1	1					
Hemiptera		1			1	1		1						
Himenoptera					1	5								
Lepidotera					1	1								
Neuroptera						1								
Symphyla													20	
Larvae:														
Coleoptera	10		10											
Diptera									10					
Others							10	10					10	
QBS	45	28	41	25	39	19	42	22	41	28	40	30	70	30

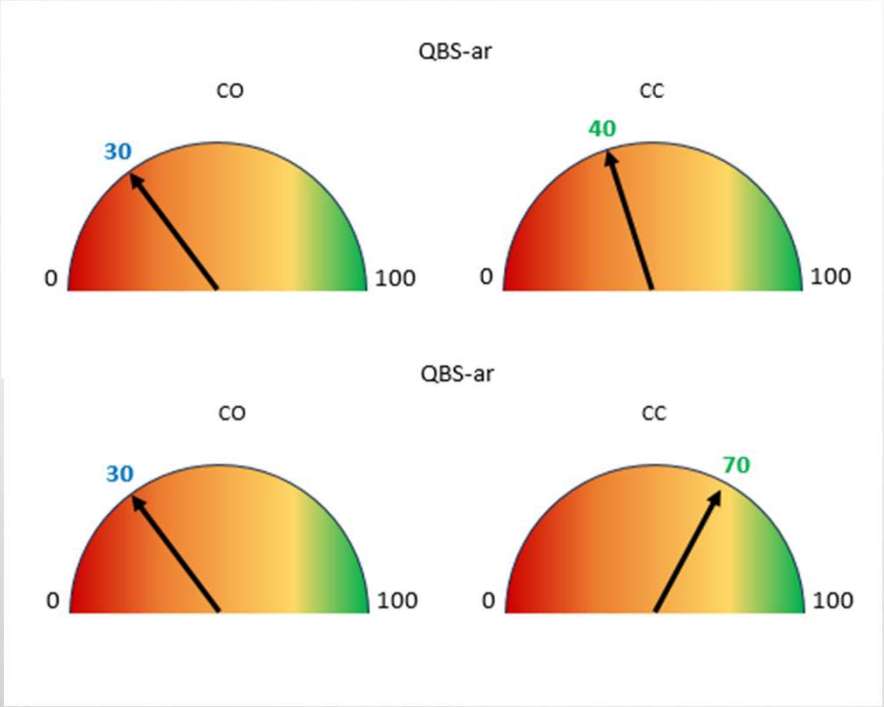


QBS-ar average for high quality soils: **93,7**

ARTHROPODS DIVERSITY: QBS - ar

Chamusca 2023

- RESULTS



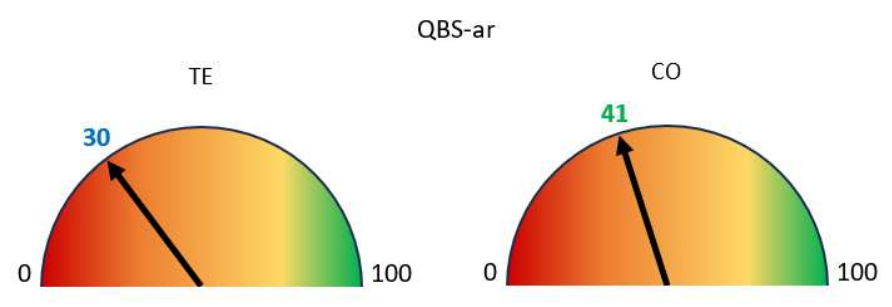
05.06.2023

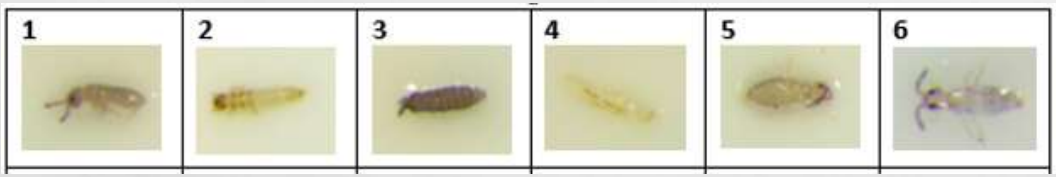
24.07.2023

ARTHROPODS DIVERSITY: QBS - ar

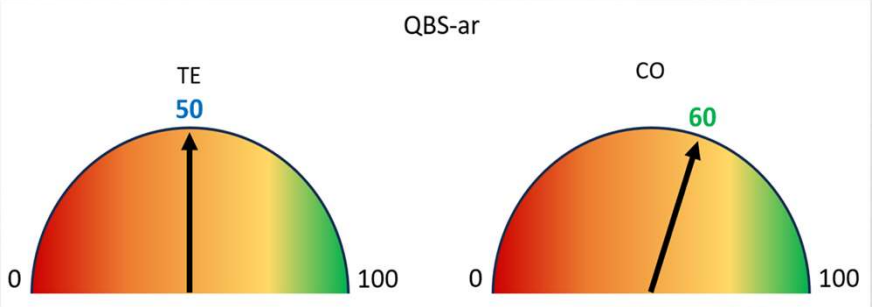
- RESULTS

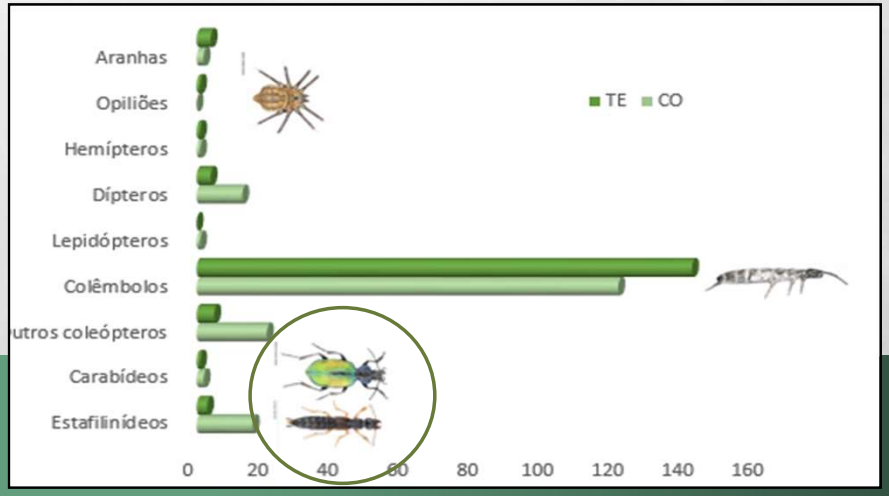
S. João Brito, Golegã 2023





Brejão 2023

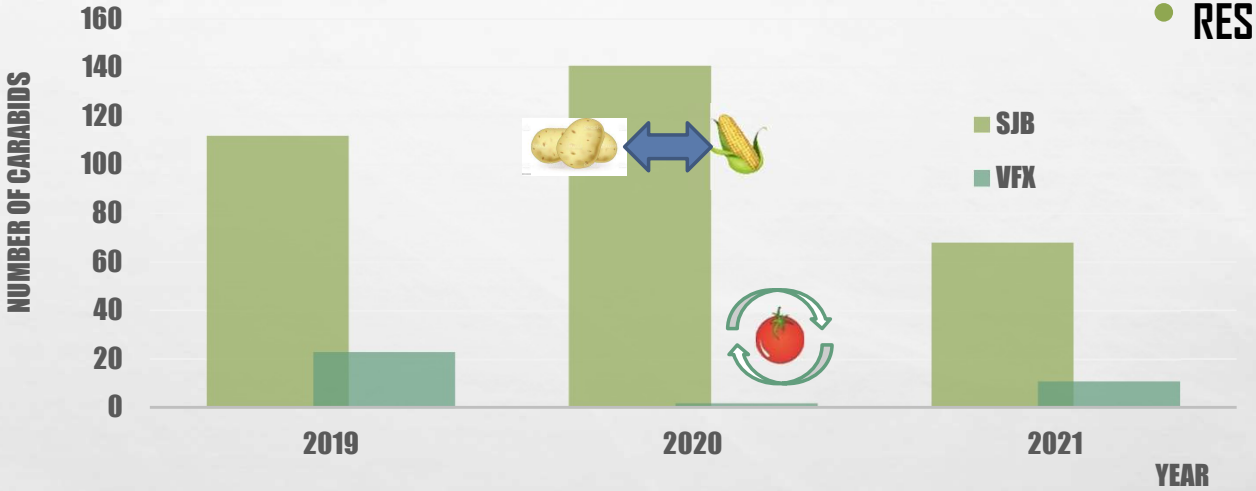




ARTHROPODS DIVERSITY: pitfall traps

CARABIDS

RESULTS



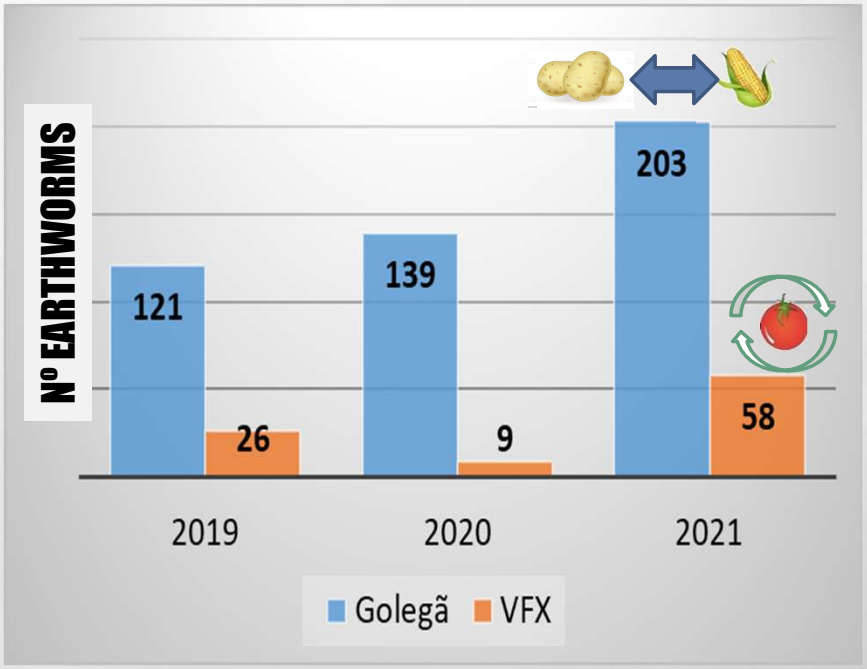
271 carabids from 16 genera were sampled during the three-year study (2019-2021)

SJB the abundance was approximately 89% relative to the total carabids

In 2019, 2020, 2021, carabids captured in SJB field represented 83.0%, 98.6%, 91.9%, respectively

EARTHWORMS

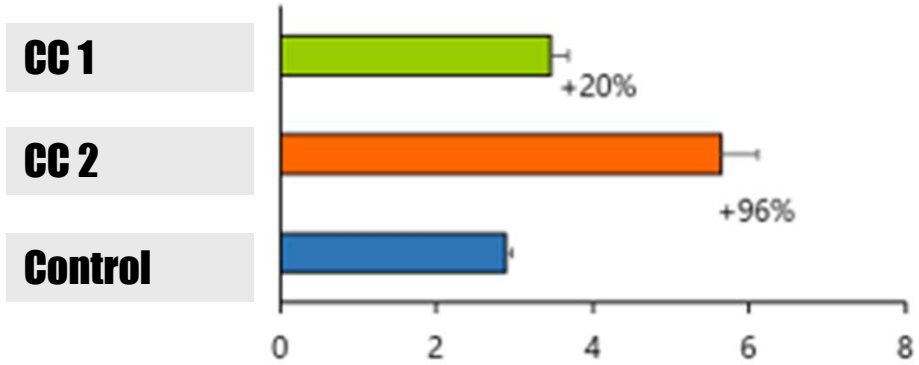
RESULTS



INIAV TEAM

Microbioma – soil enzymes

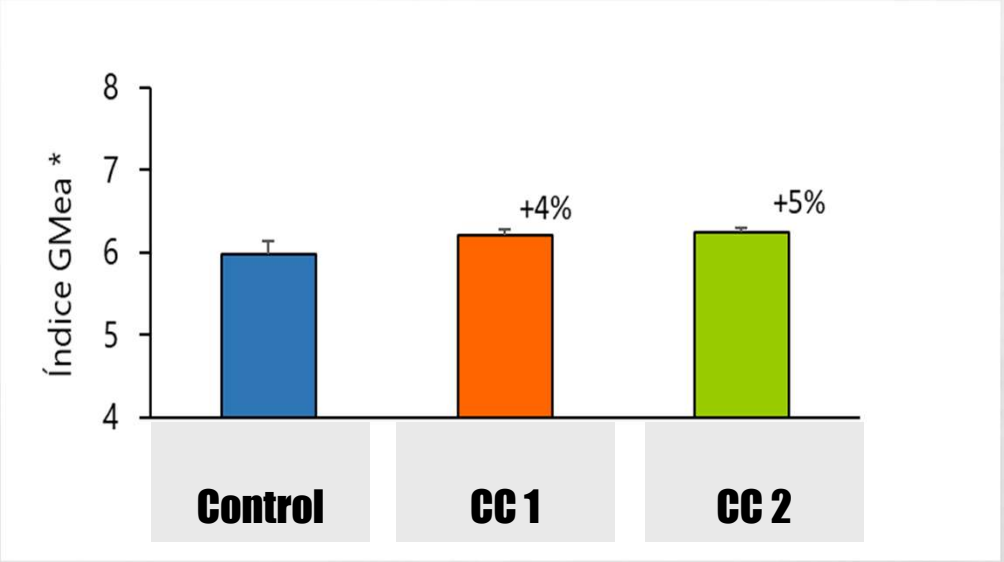
- RESULTS



TEI – Total enzyme activity index based on dehydrogenase, alkaline phosphatase, beta-glucosidase and aryl-sulfatase activities

- RESULTS

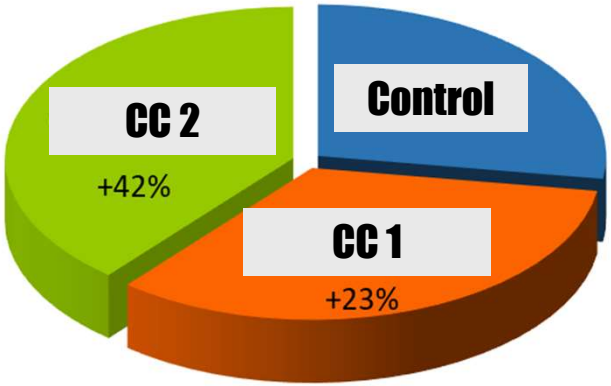
Microbioma – bacteria and fungi



* Geometric mean of bacteria and fungi abundance

RESULTS

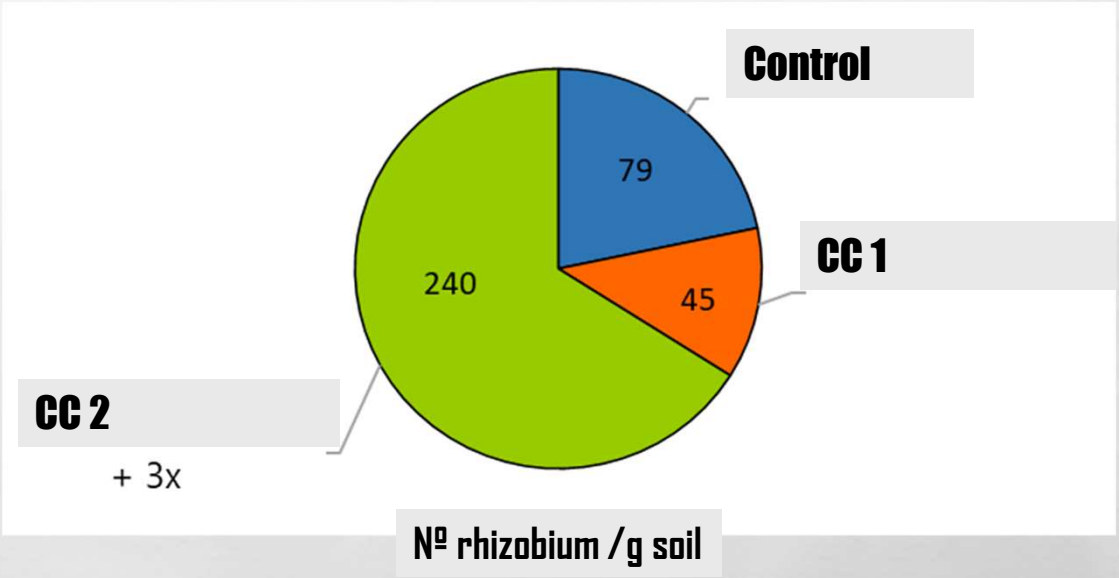
Microbioma – fungi – genus abundance



Shannon Index
(genera with abundance >10^4 colony forming units/g soil)

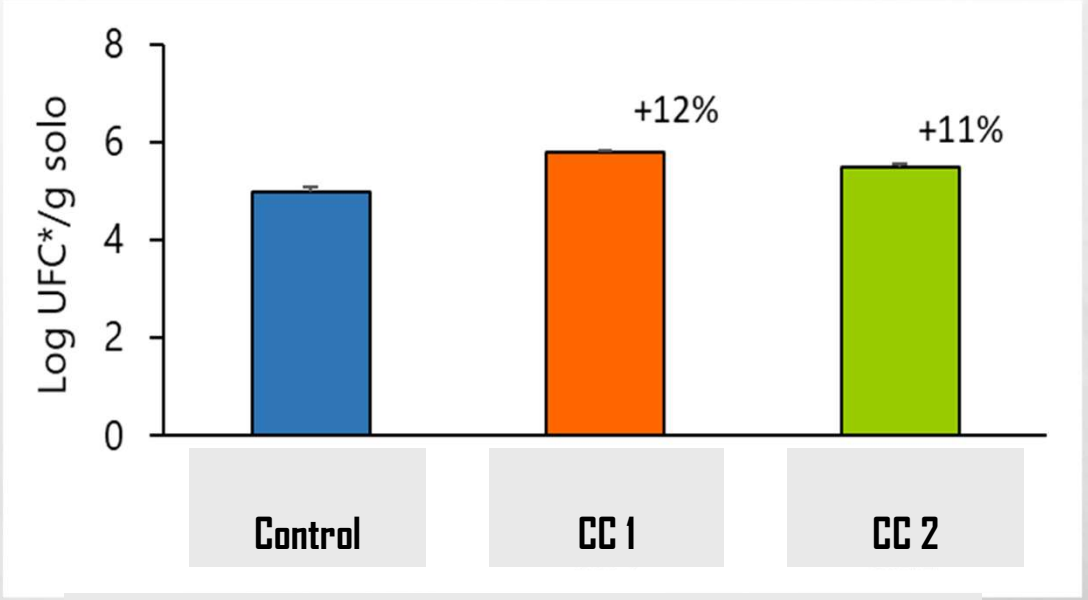
RESULTS

Microbioma – Rhyzobium bacteria



- RESULTS

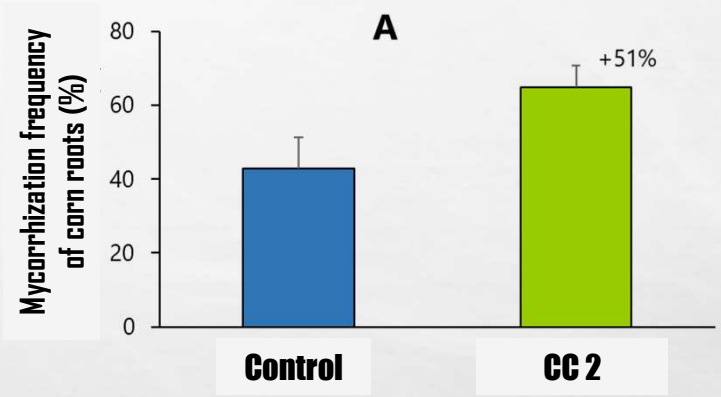
Microbioma – phosphate-solubilizing bacteria

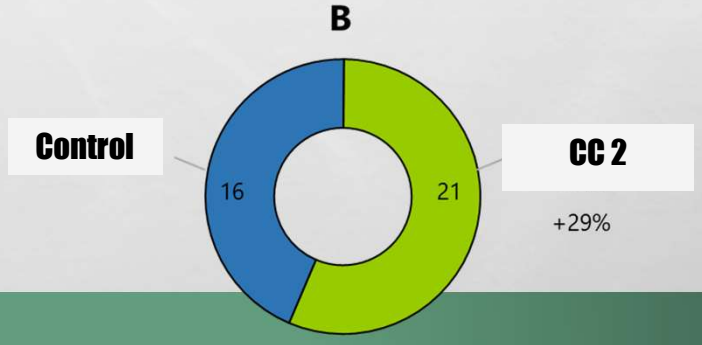


* Colony forming units

- RESULTS

Microbiome – endomycorrhizae

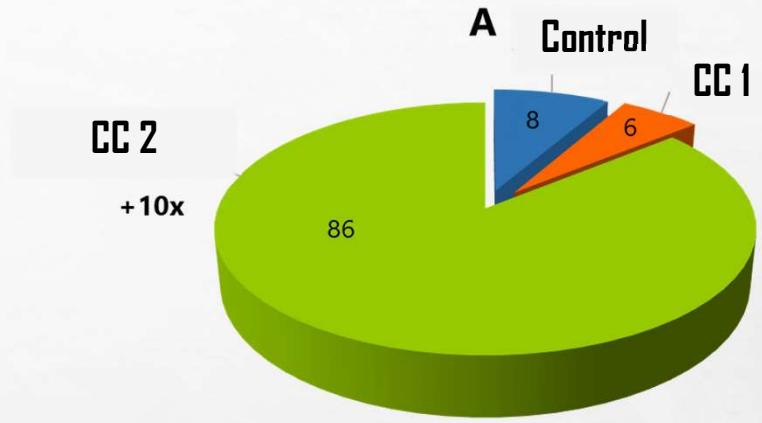




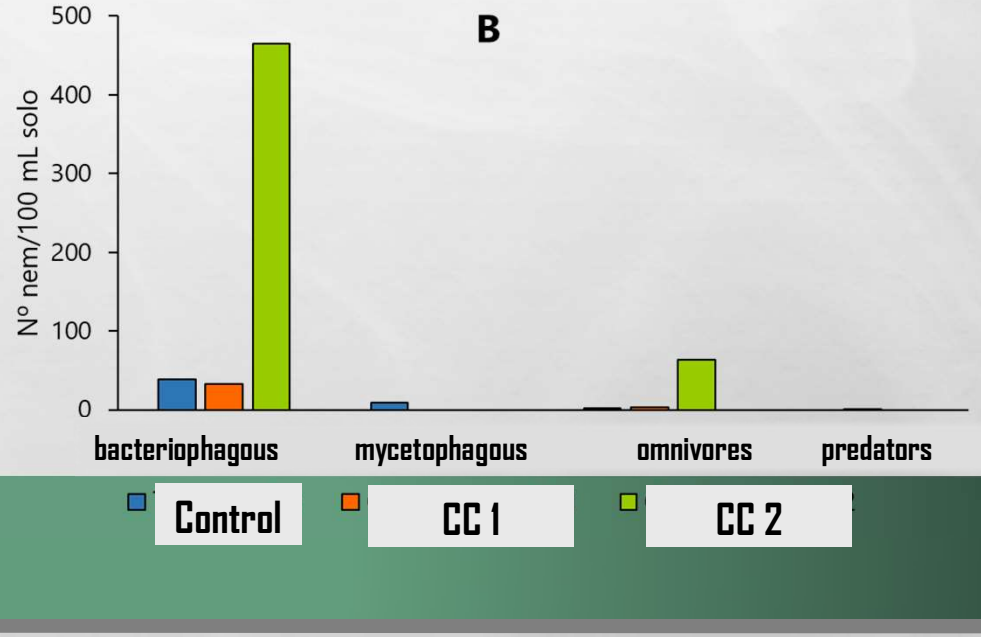
Nº mycorrhizal spores /g soil

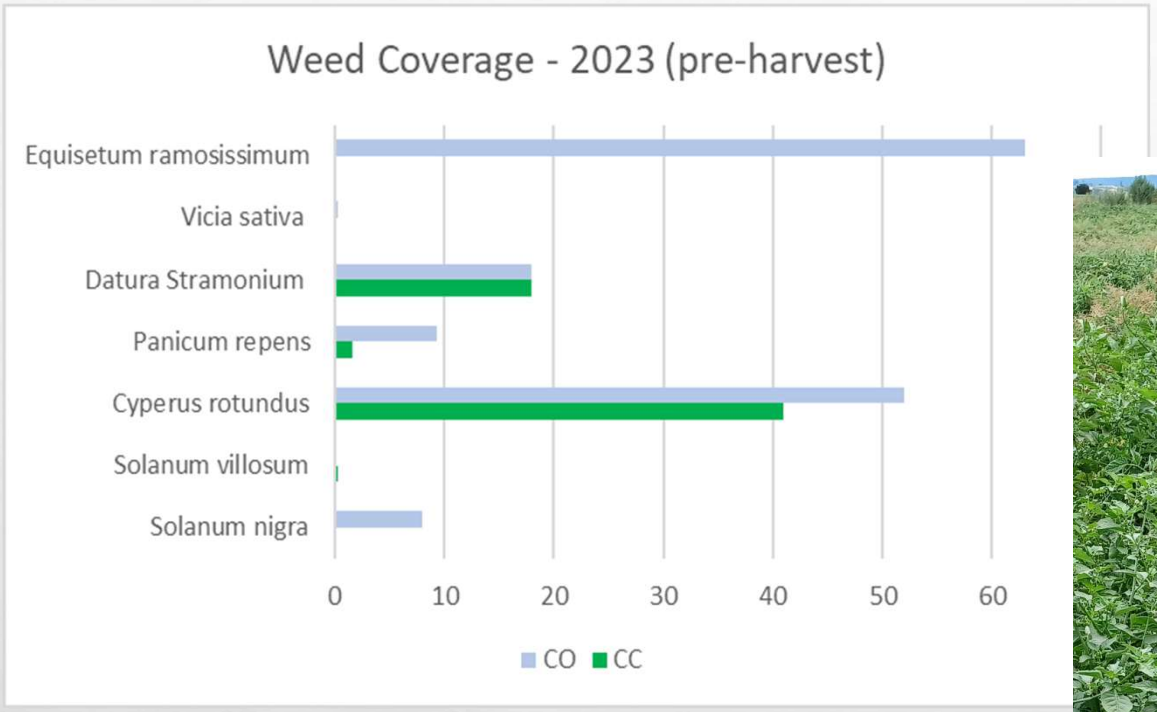
RESULTS

Nematodes



Relative proportion of nematodes on soil samples





CO

CC

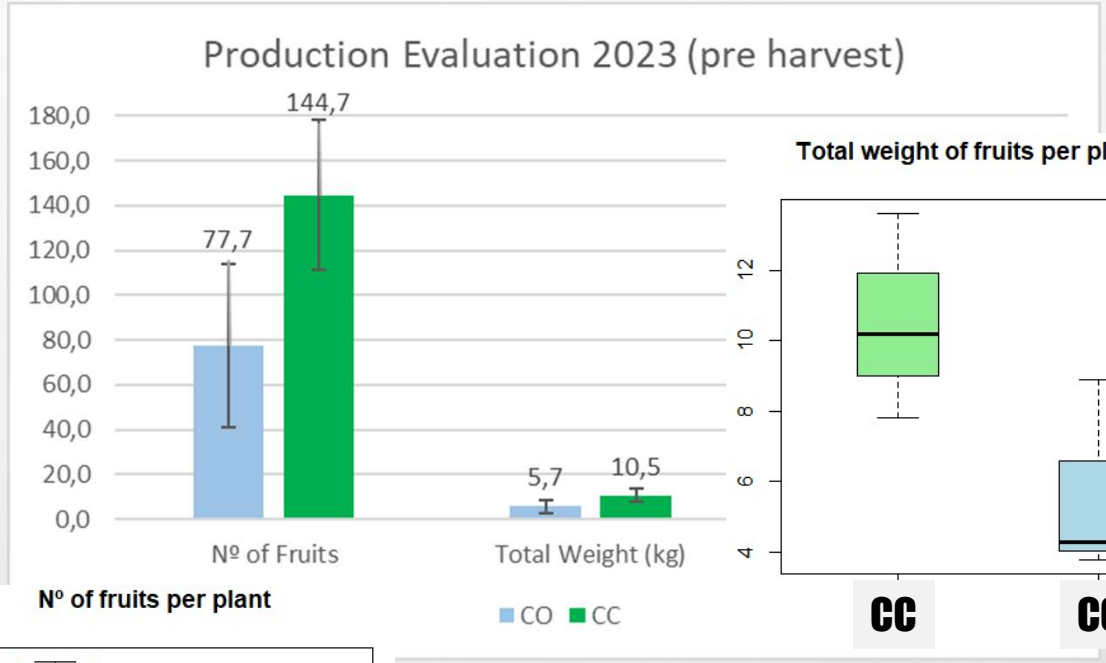
Weed coverage (pre-harvest) – 2023

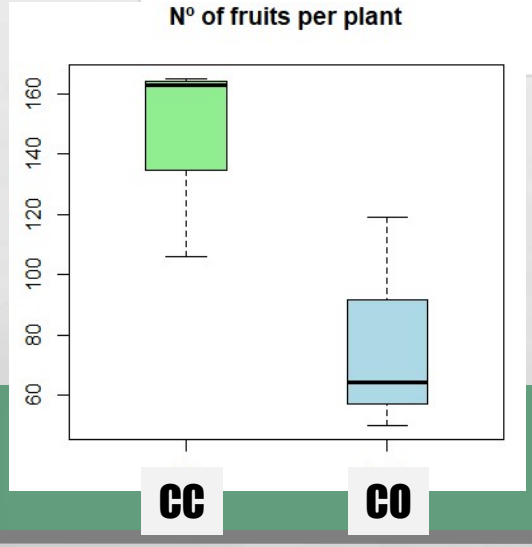
BiodiversiTY

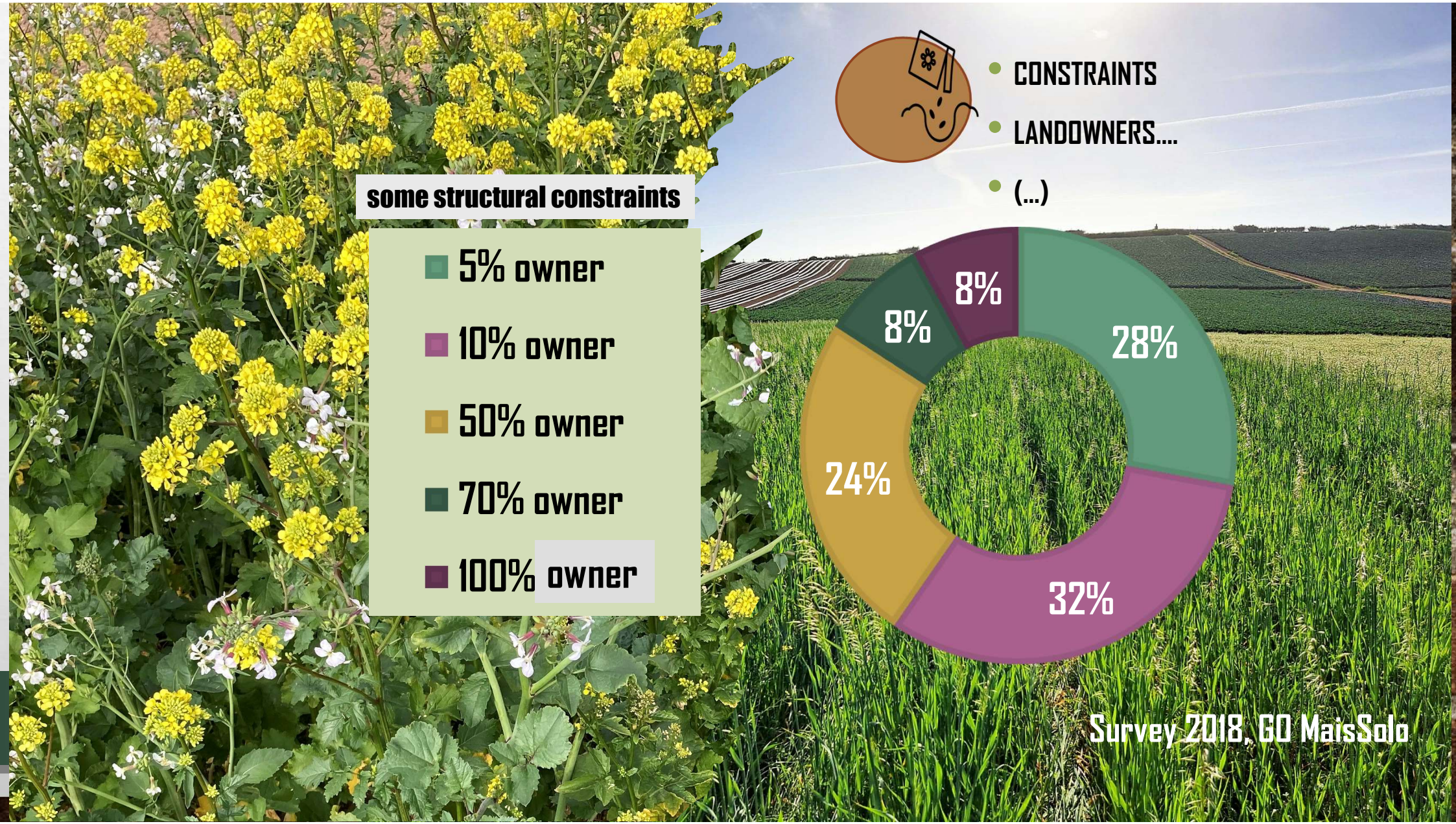
NutrienTS

CarbON

“WeeDS”

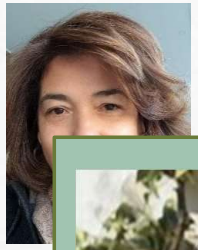
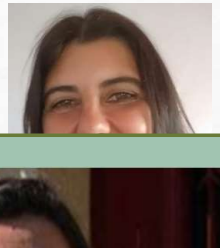


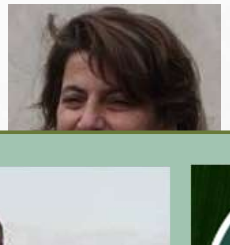
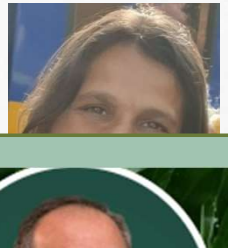



some structural constraints
5% owner
10% owner
50% owner
70% owner
100% owner
CONSTRAINTS
LANDOWNERS....
(...)
28%
32%
24%
8%
8%
Survey 2018, GD MaisSolo

MEET the TEAM

ESAS


Maria d

Cardoso

FERTIPRADO

Ana Barr

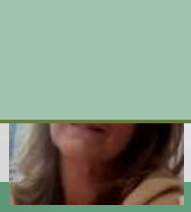
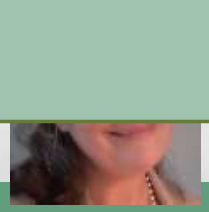
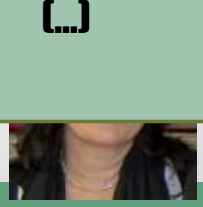
Alexandre Oliveira

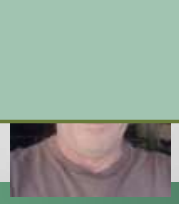
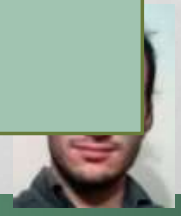
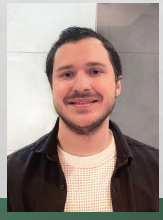


e outros produtores e técnicos

João freire
Mário Romão
Rodrigo Vinagre
Emanuel Antunes
Renato Gouveia
(...)

INIAV

Paula Fareleira Isabel V. Castro Lurdes Inácio Adélia Varela Pablo Pereira José Cotta Ricardo Soares Anton Denysov

OBRIGADA
THANK YOU

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- MARIA.GODINHO@ESA.IPSANTAREM.PT