asfertglobal

O nascer de uma nova agricultura

Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective

Pedro Sebastião
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The need for biofertilizers: a market perspective

The European Commission (EU) created the **European Green Deal**, a roadmap for Europe to become a **climate-neutral continent by 2050.**

The EU Common Agricultural Policy **promotes** the adoption and use of **bio-based products** and **organic farming**. It provides up to 30% of the budget as direct green payments to farmers to maintain sustainable agricultural practices.

Farm to Fork

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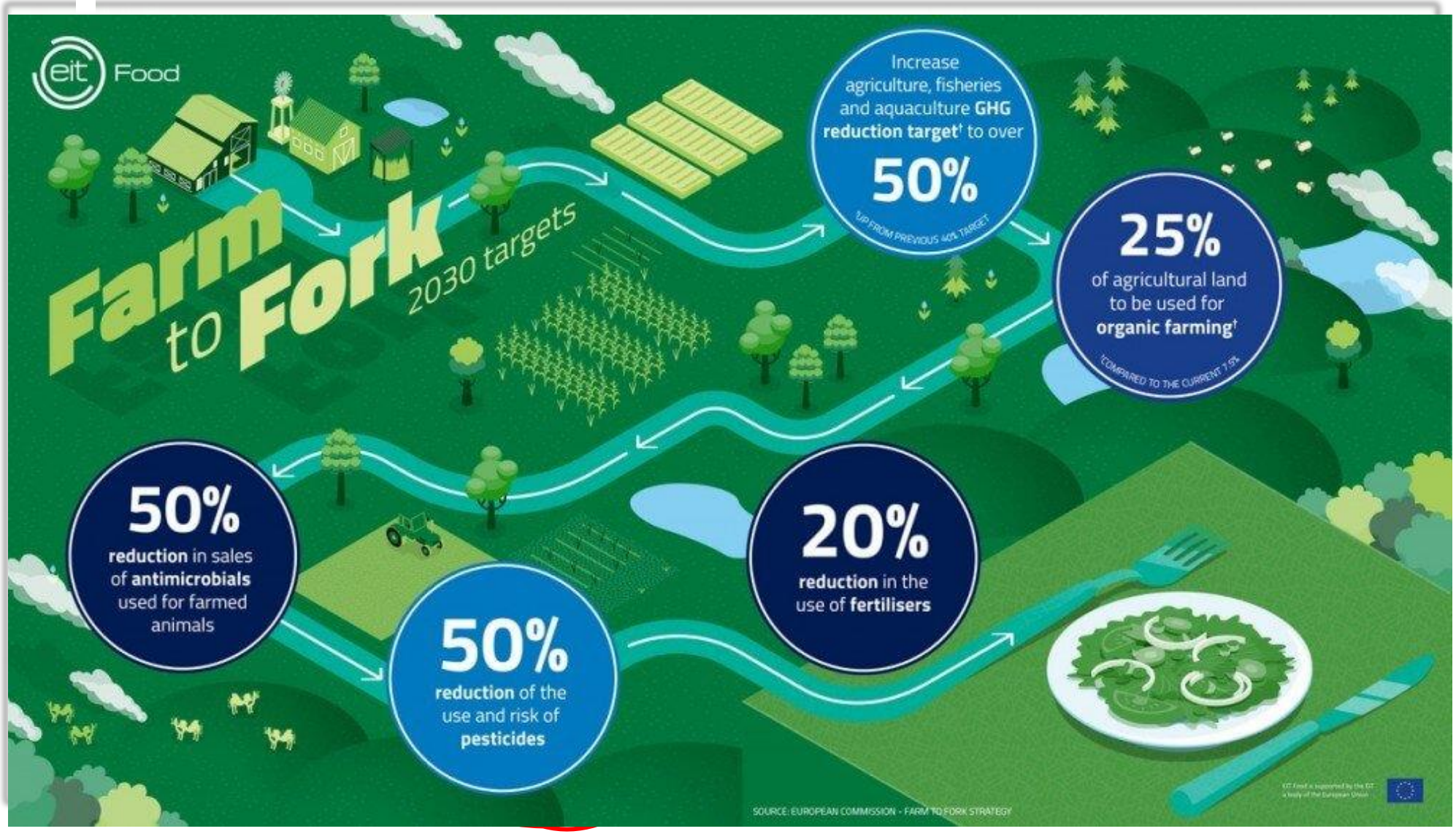

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The need for biofertilizers: a market perspective

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The need for biofertilizers: a market perspective

EU 2019: M513 people

EU 2030: M738 people

Source: European Union Census Bureau

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Tweet

Bill Gates
@BillGates

It may not sound appetizing, but this fungus could help feed the hungry: b-gat.es/1lzxpgi via @PBS

NATURE

The Next Green Revolution May Rely on Microbes

To feed a planet of 9 billion, scientists are breeding mycorrhizal fungi that promise to boost crop yields by unlocking more nutrients in the soil.

BY CYNTHIA GRABER THURSDAY, JUNE 12, 2014 NOVA NEXT

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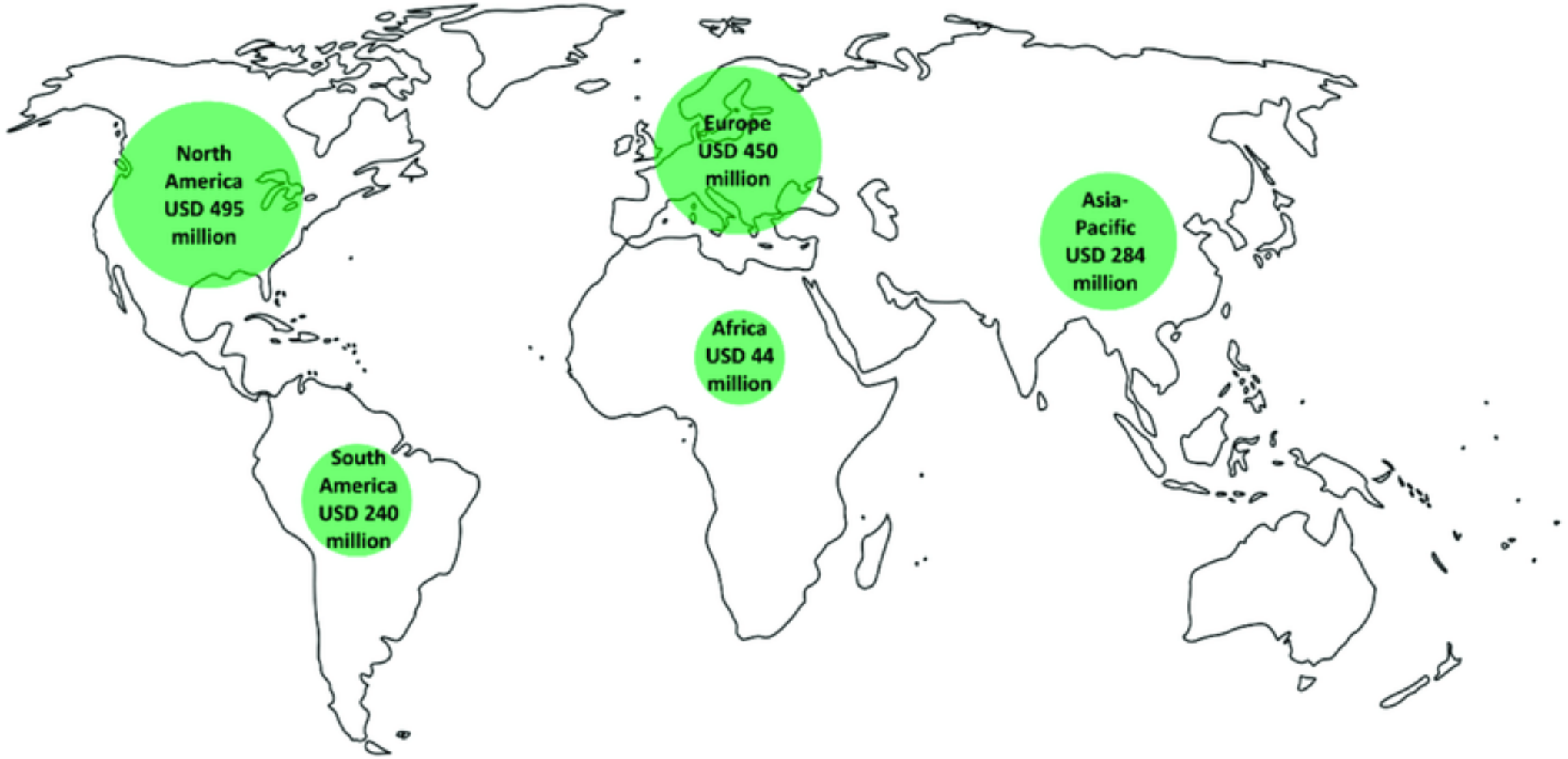
Biofertilizer Market (2017)



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Biofertilizer Market

Global Market 2020: USD 2900M

Estimated CAGR: 12% from 2021 to 2031

Global Biofertilizer industry 2031 (expected): USD 5200M

The Europe Biofertilizers Market size is estimated at **USD 580M in 2023** and is expected to reach USD 1030M by 2028.

Regulation (EU) 2019/1009 of the European Parliament and of the Council laying down rules on the making available on the market of EU fertilising products and amending Regulations

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Plant biostimulants: Definition, concept, main categories and regulation

Article *in* Scientia Horticulturae · October 2015

DOI: 10.1016/j.scienta.2015.09.021

Patrick du Jardin

Gembloux Agro-Bio Tech, University of Liège, Liège, Belgium

Contents

Box 1: Glossary of 'biosolutions' contributing to sustainable plant productions

Biostimulant: A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content. By extension, plant biostimulants also designate commercial products containing mixtures of such substances and/or microorganisms.

Biofertiliser: A biofertiliser is any bacterial or fungal inoculant applied to plants with the aim to increase the availability of nutrients and their utilization by plants, regardless of the nutrient content of the inoculant itself. Biofertilisers may also be defined as microbial biostimulants improving plant nutrition efficiency.

Biocontrol: The control of one organism by another. Biocontrol agents used in plant productions are living organisms protecting plants against their enemies, i.e. reducing the population of pests or diseases to acceptable levels. Modes of action may include competition, antibiosis, parasitism and also Induced Systemic Resistance which is mediated by the plant.

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	Humic acids	Seaweed extracts	Protein hydrolysate	Glycine betaine	Plant Growth-promoting Rhizobacteria
Cellular mechanism (*i.e.* interaction with cellular components and processes) ↓	Activate plasma membrane proton-pumping ATPases, promote cell wall loosening and cell elongation in maize roots (*Zea mays*) (Jindo et al., 2012)	*Ascophyllum nodosum* extracts stimulate expression of genes encoding transporters of micronutrients (*e.g.* Cu, Fe, Zn) in oilseed rape (*Brassica napus*) (Billard et al., 2014)	Enzymatic hydrolysate from alfalfa (*Medicaco sativa*) stimulates phenylalanine ammonia-lyase (PAL) enzyme and gene expression, and production of flavonoids under salt stress (Ertani et al., 2013)	Protects photosystem II against salt-induced photodamage in quinoa (Shabala et al., 2012), likely via activation of scavengers of reactive oxygen (Chen & Murata , 2011)	*Azospirillum brasilense* releases auxins and activates auxin-signalling pathways involved in root morphogenesis in winter wheat (*Triticum aestivum*) (Dobbelaere et al., 1999)
Physiological function (*i.e.* action on whole-plant processes) ↓	Increased linear growth of roots, root biomass	Increased tissue concentrations and root to shoot transport of micronutrients	Protection by flavonoids against UV and oxidative damage (Huang et al., 2010)	Maintenance of leaf photosynthetic activity under salt stress	Increased lateral root density and surface of root hairs
Agricultural/horticultural function (*i.e.* output traits relevant for crop performance) ↓	Increased root foraging capacity, enhanced nutrient use efficiency	Improved mineral composition of plant tissues	Increased crop tolerance to abiotic (*e.g.* salt) stress	Increased crop tolerance to abiotic (*e.g.* high salinity) stress	Increased root foraging capacity, enhanced nutrient use efficiency
Economic and environmental benefits (*i.e.* changes in yield, products quality, ecosystem services)	Higher crop yield, savings of fertilisers and reduced losses to the environment	Enhanced nutritional value, 'biofortification' of plant tissues (increased contents in S, Fe, Zn, Mg, Cu)	Higher crop yield under stress conditions (*e.g.* high salinity)	Higher crop yield under stress conditions (*e.g.* high salinity)	Higher crop yield, savings of fertilisers and reduced losses to the environment

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key points of the new EU 2019/1009 regulation

Regulating new products intended to improve nutritional efficiency and setting down the same rules for all players at European level.

Encourage European self-sufficiency within a sustainable agriculture scenario, contributing to the development of the circular economy inside the EU.

While the former EU 2003/2003 regulation laid down the rules for inorganic fertilizers and liming amendments only, the new EU 2019/1009 regulation **establishes up to seven (7) Product Function Categories (PFCs), that are defined based on the functions attributed to a specific product.**

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The new EU 2019/1009 regulation includes and regulates other categories of fertilizers with functions that go beyond the mere supply of nutrients to the soil or plant.

These Product Function Categories PFCs cover:

PFC 1: fertilizers (including inorganic, organic and organo-mineral fertilizers);

PFC 2: liming materials;

PFC 3: soil improver;

PFC 4: growing medium;

PFC 5: inhibitor;

PFC 6: plant biostimulant;

- (6 A) Microbial plant biostimulant
  - *Azotobacter* spp.
  - Mycorrhizal fungi
  - *Rhizobium* spp.
  - *Azospirillum* spp.
- (6 B) Non microbial plant biostimulant

PFC 7: fertilizing product blend.

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The new EU 2019/1009 regulation includes, regulates and defines plant biostimulant products.

The previous regulation did not include biostimulants and they were only covered in certain individual national laws.

The development is the definition of the term biostimulant in the regulation, which is linked to the use and characteristics of these products. The text indicates that a biostimulant "is an EU fertilizing product whose function is to stimulate plant …

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What changes does this imply for companies that produce and sell biostimulants?

In this new scenario, biostimulants have to undergo a **prior assessment process** and obtain the **conformity of accredited entities** in this regard.

P.e.: Manufacturing companies have to carry out **efficacy trials** in advance to prove the statistically significant effect of their biostimulant product.

Manufacturers can only state the benefits of their product on the label after having proven these in field trials on tested crops.

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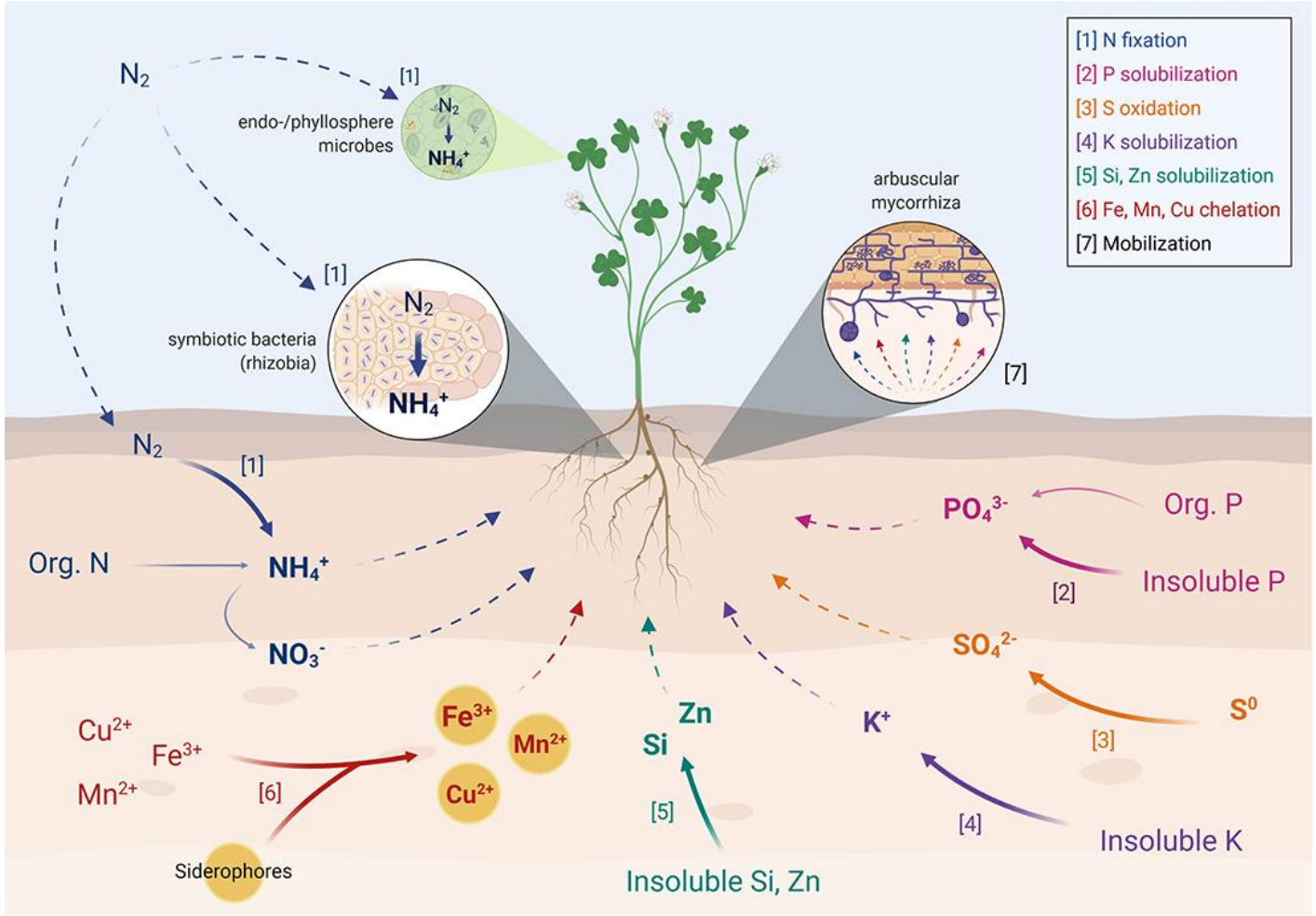

Source: Mitter *et All*. (2021)
https://www.frontiersin.org/articles/10.3389/fsufs.2021.606815/full

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ECONOMIA

Fileira do milho aposta na investigação para se tornar mais competitiva

O Dia de Campo do Centro Nacional de Competências das Culturas do Milho e Sorgo reuniu 300 participantes em Coruche e durante os trabalhos foram assinados dois protocolos estratégicos para a fileira do milho que envolvem instituições de ensino e investigação.

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Instituto Nacional de Investigação Agrária e Veterinária, I.P.

RELATÓRIO DE ANÁLISE DE TERRA

Requisitante: ANPROMIS - GO QUALIMILHO

L0246 ISO/IEC 17025 Ensaios

Concelho Coruche	Profundidade 0-20 cm	Nº Lab 270	
Freguesia Coruche	Cultura Milho grão	Inicio Análise	21/05/2020
s/ Ref. T 21/23 - Est. Exp. António Teixeira - Data de colheita: 11-05-2020		Fim Análise	30/06/2020

PARÂMETROS		RESULTADOS	INTERPRETAÇÃO *
Fósforo extraível*	P2O5 mg/kg	217	**********
Potássio extraível*	K2O mg/kg	180	**********
Magnésio extraível*	Mg mg/kg	79	**********
Matéria Orgânica*	%	0,95	**********
Textura*			Grosseira
pH(H2O)a)		6,0	Pouco ácido
Nec. Cal*	CaCO3 t/ha	0	
Ferro extraível*	Fe mg/kg	80	**********
Manganês extraível*	Mn mg/kg	37	**********
Zinco extraível*	Zn mg/kg	7,4	**********
Cobre extraível*	Cu mg/kg	1,2	**********
Boro extraível*	B mg/kg	<0,20	****

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Application: 5l/ha de Kiplant All-Grip

and

Reduction of*:*

de 450kg/ha base fertilizer*: 150kg/ha de 13-11-21*

(33%)

de 150kg/ha Starter fertilizer: *150kg/ha de 21-17-0*

(Totalidade)

de 400kg/ha top dresser fertilizer*: 100kg/ha de 40-0-0*

(25%)

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Related to Control

Reduction of:

31% do Nitrogen

56% do Phosphorus

33% do Potassium

Reduction of 400kg/ha of fertilizers from a total of 1000kg/ha

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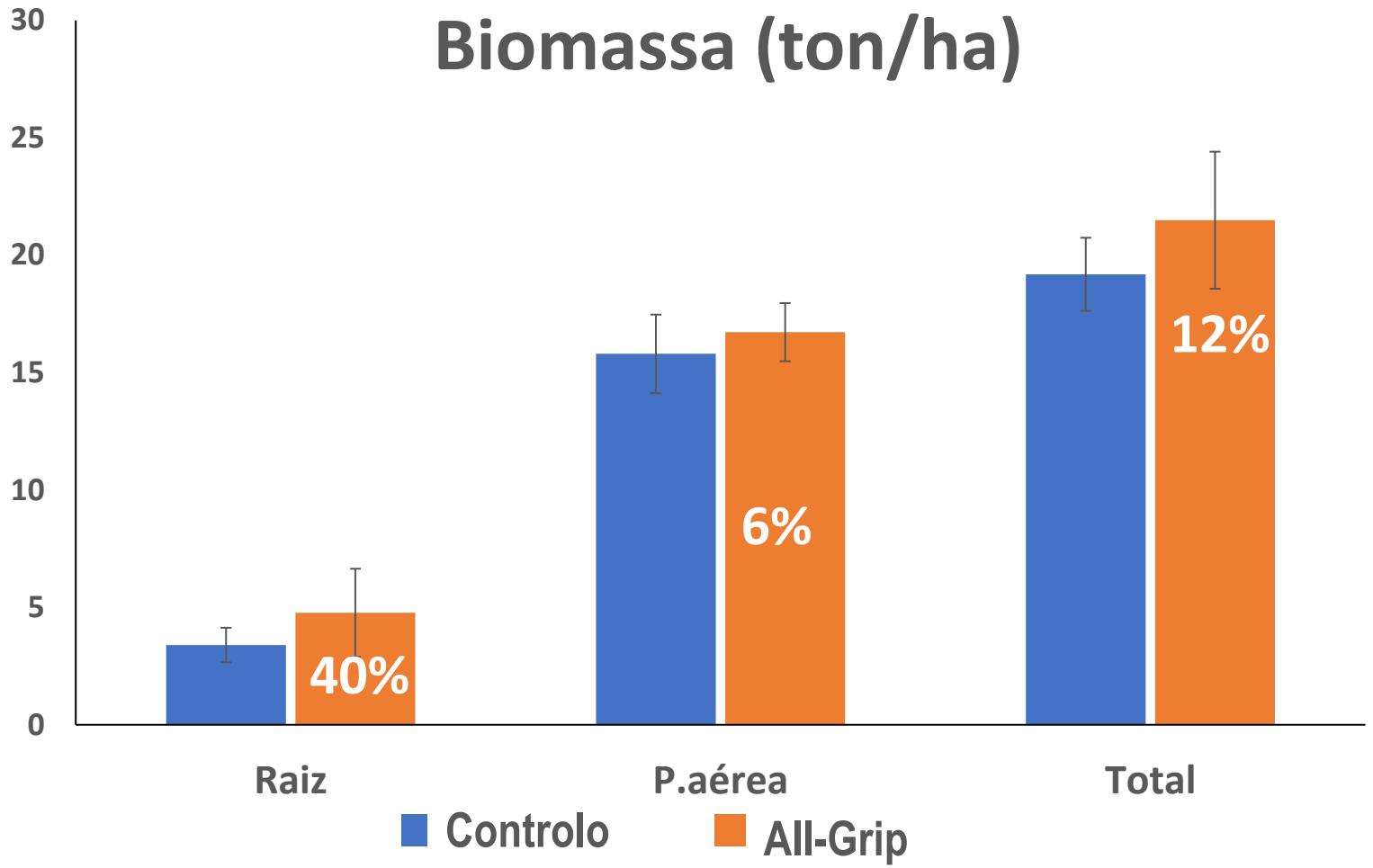
***Results** (1 Ago 2022):*



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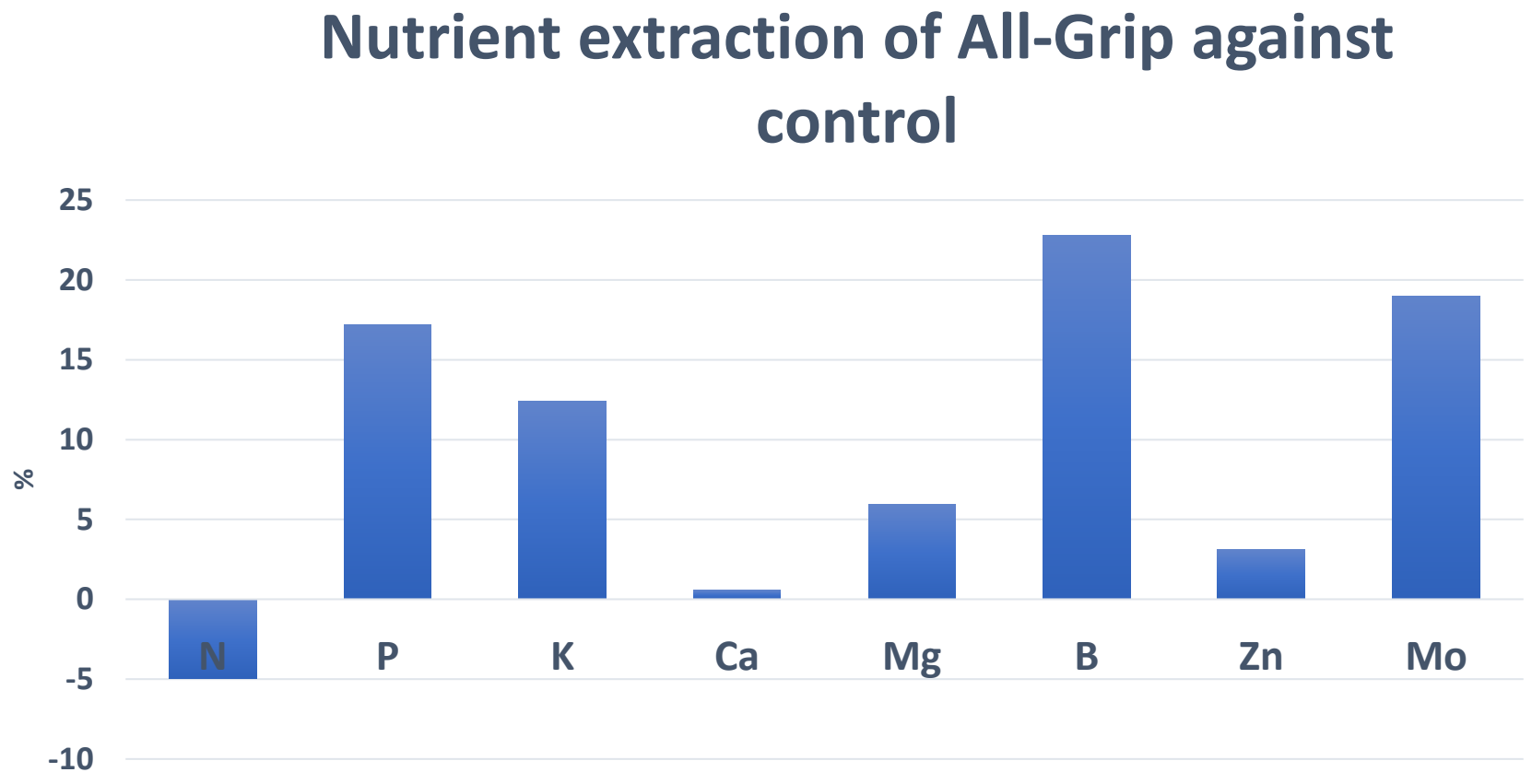
***Resultados** (1 Ago 2022):*



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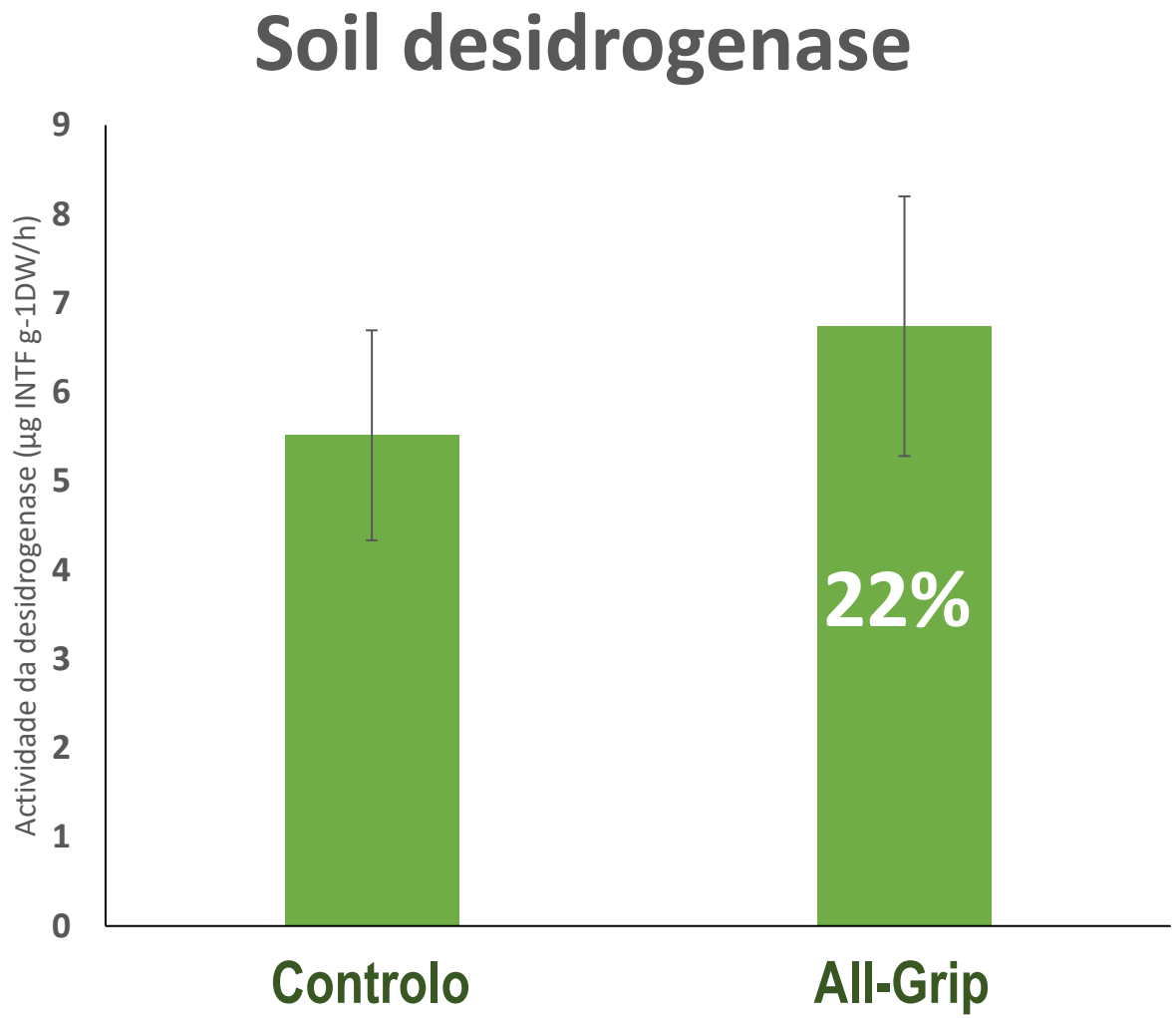

Enzimas no solo	
	Aumento (%)
Xyl - β-xylosidase	+ 70,3
Nag - N-acetilglucosaminidase	+ 105,2
GLS- β-glucosidase	= 24,7
Pho - Phosphatase	+ 62,8

	Produção (kg/ha)
Controlo	**18 457**
Kiplant All-Grip	**18 475**

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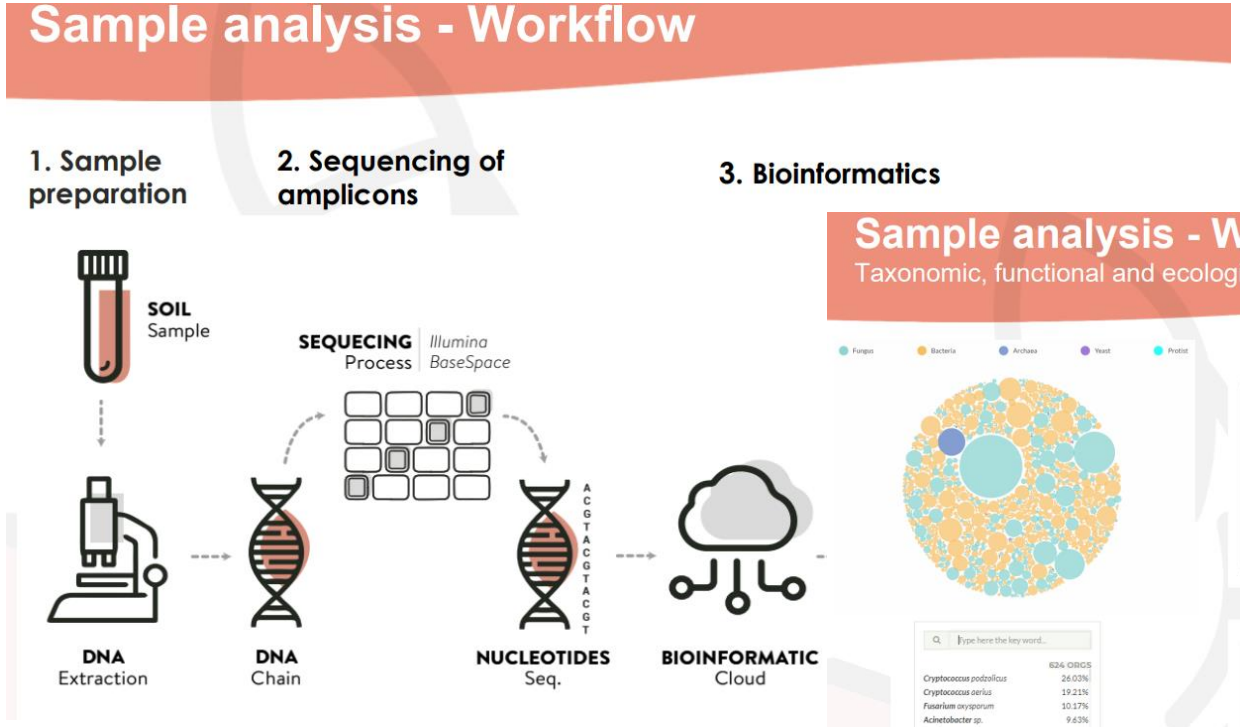
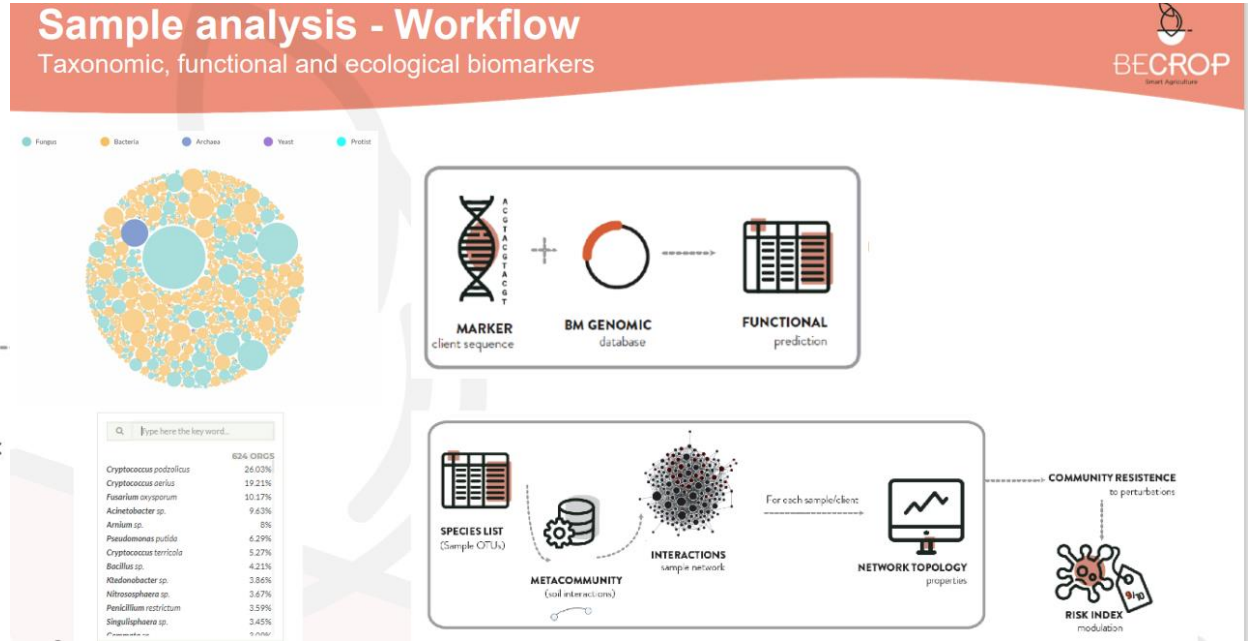
Effect of kiplant All-Grip on vineyard soil microbiome

(*B. megaterium*, >1x10^8 UFC/mL; *P. fluorescens*, >1x10^8 UFC/mL; *P. putida*, >1x10^8 UFC/mL)



BIOMEMAKERS
better Soil, better Food, better Life



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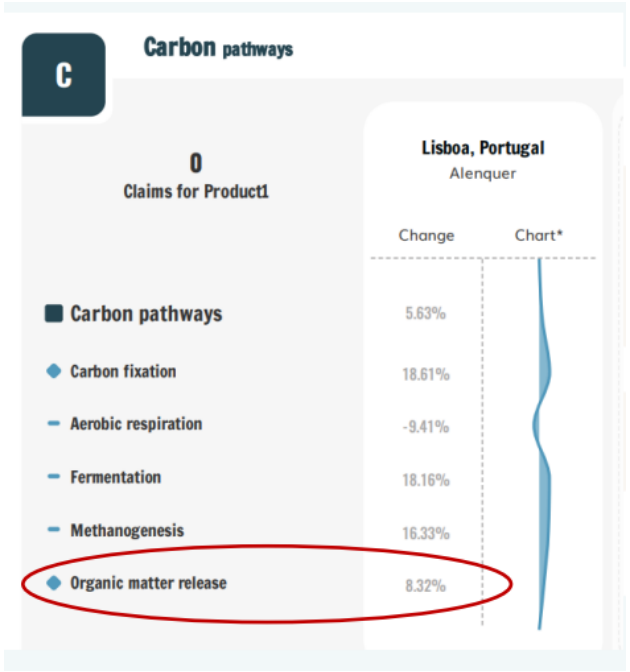
Análisis metagenómica por secuenciación de DNA de bacterias (16S rRNA) y hongos (ITS), y por secuenciación de determinados genes funcionales específicos; secuenciación por tecnología Illumina MiSeq

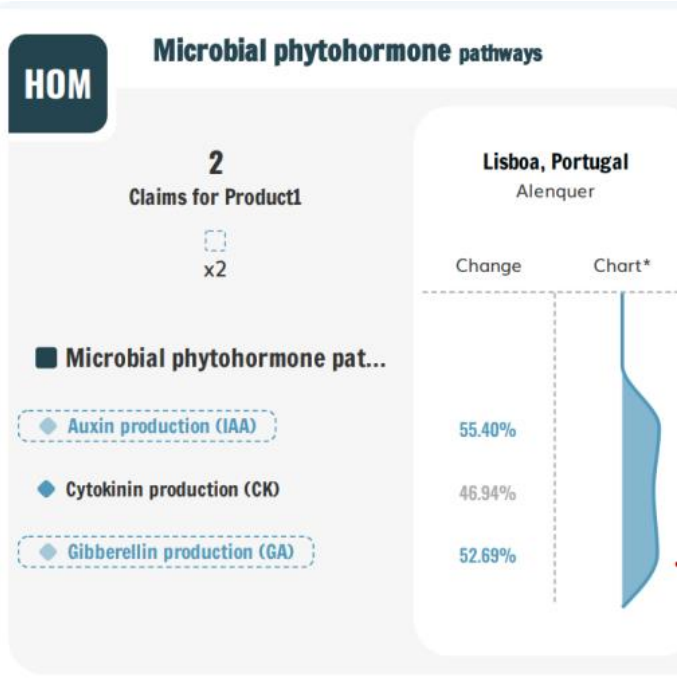
Nutritional levels

Organic matter degradation and P mineralization.

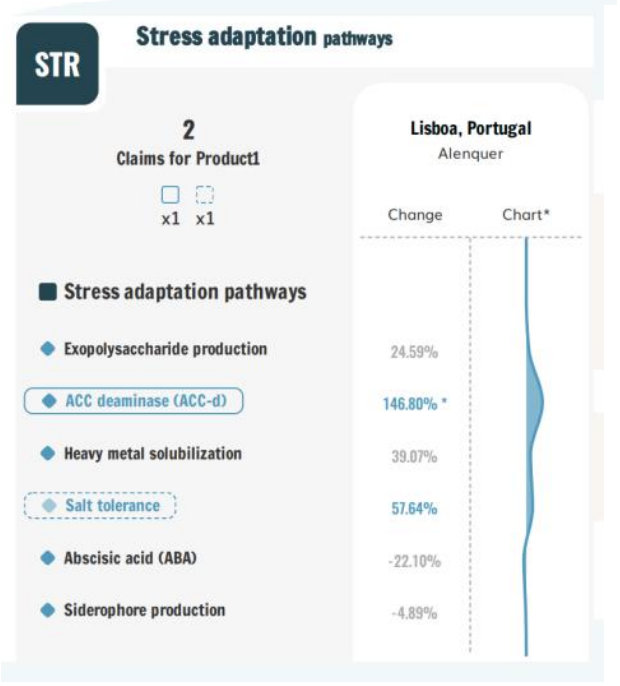


Flowering and fruiting

Phytohormone production



Stress Response



Diseño exp.: 3 bloques (réplicas), 2 tratamientos (Control y Consorcio bacteriano);i.e 6 parcelas; cada parcela con 12 plantas

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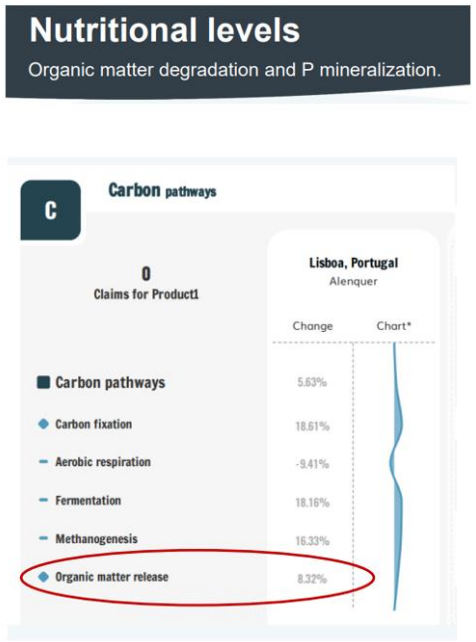
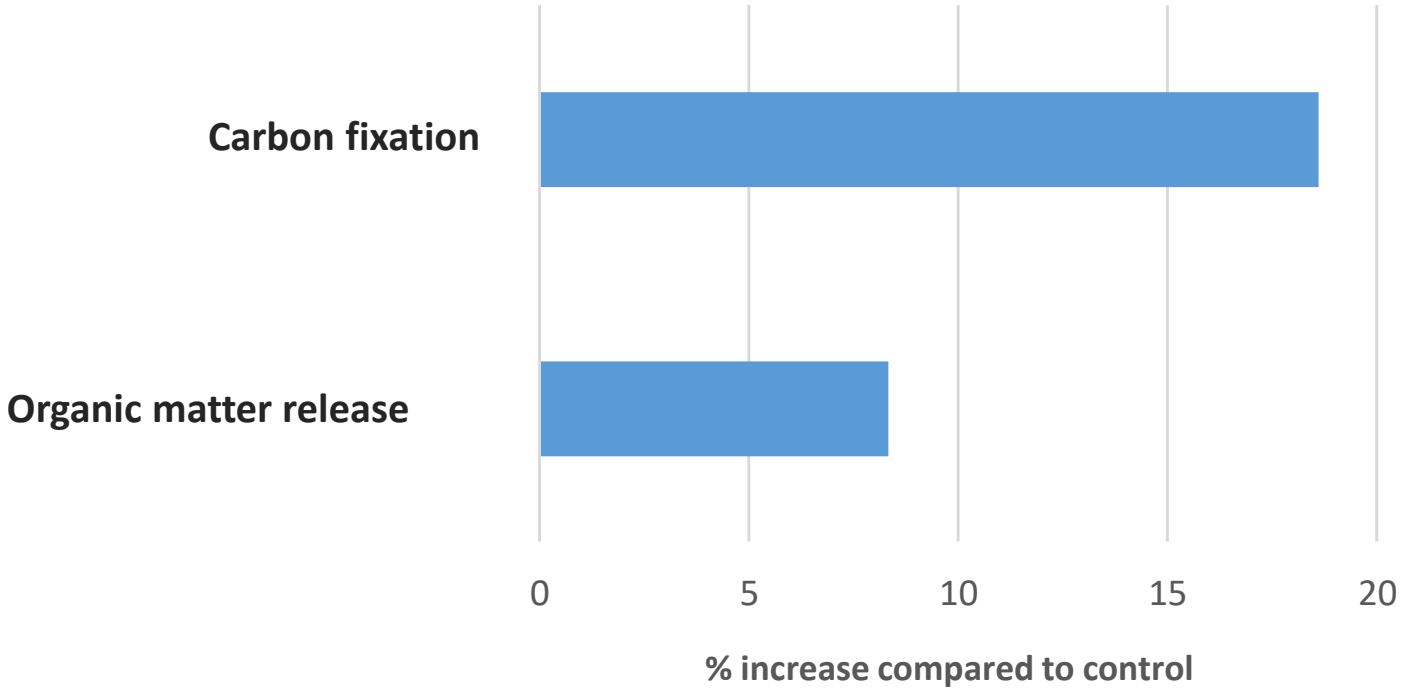


Effect of Kiplant All-grip on the microbial species related with Carbon pathways



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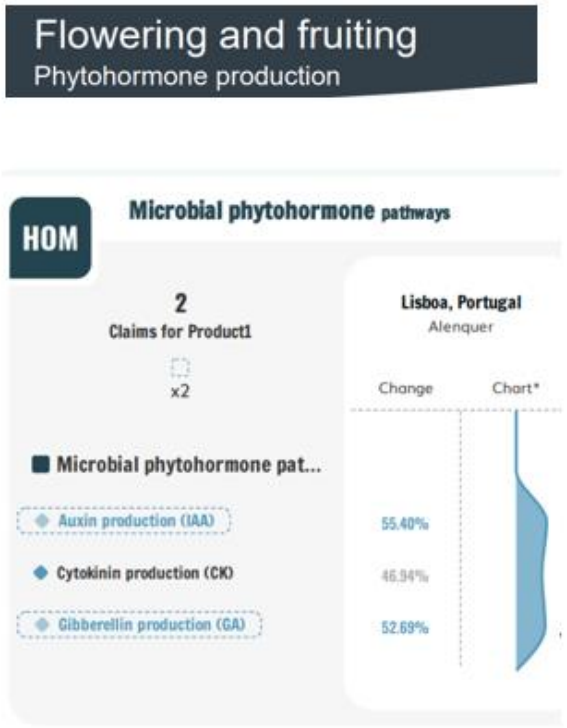
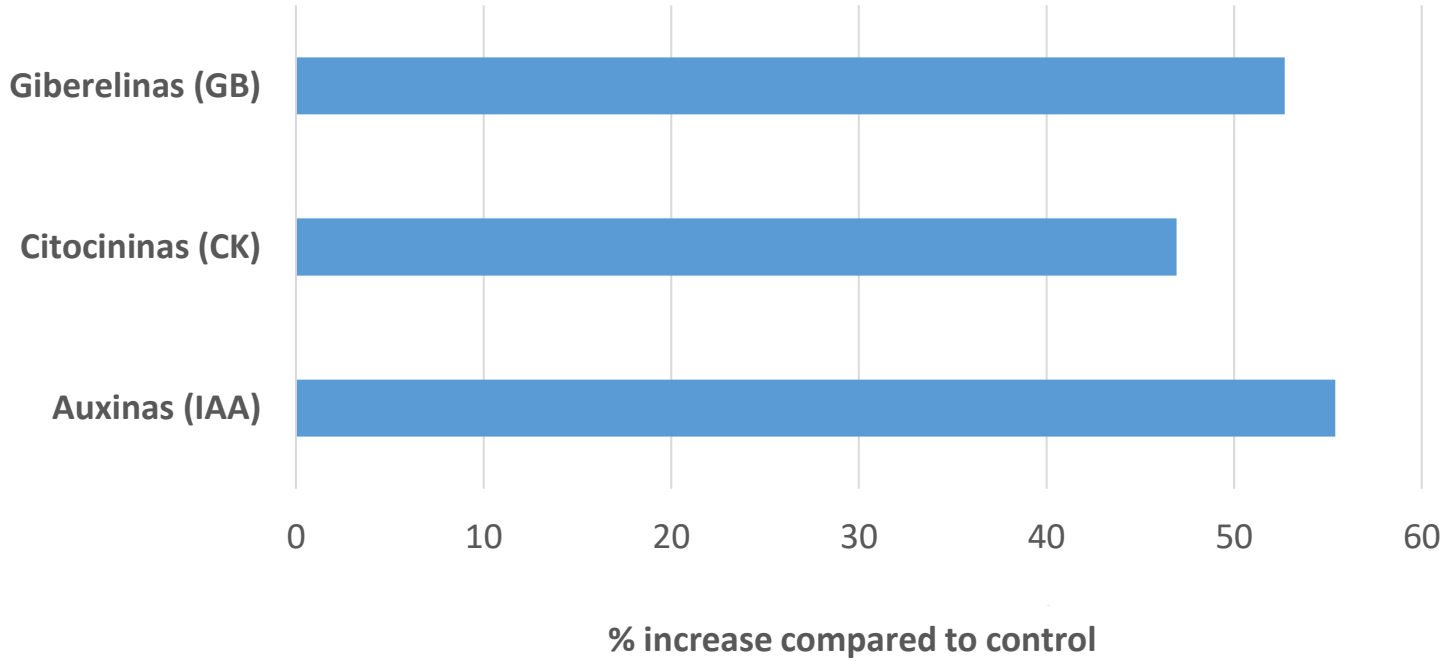


Effect of Kiplant All-grip on the microbial species related with the production of phytohormones



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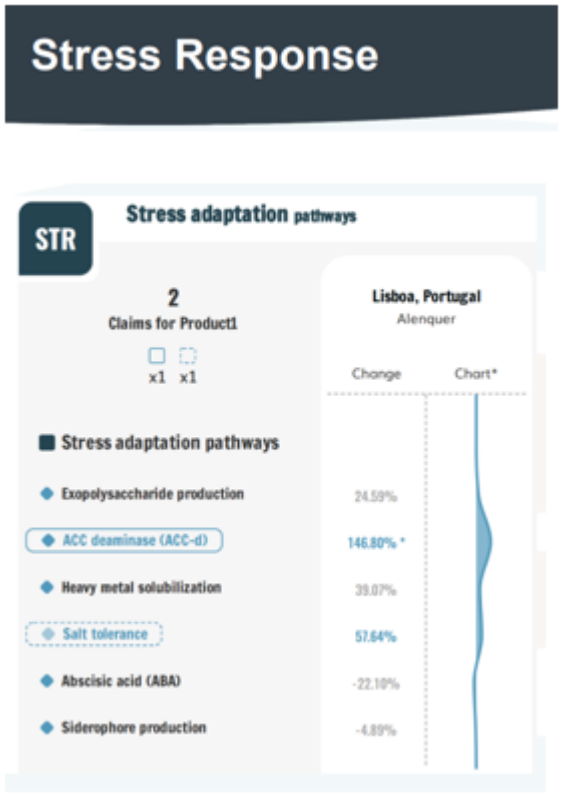
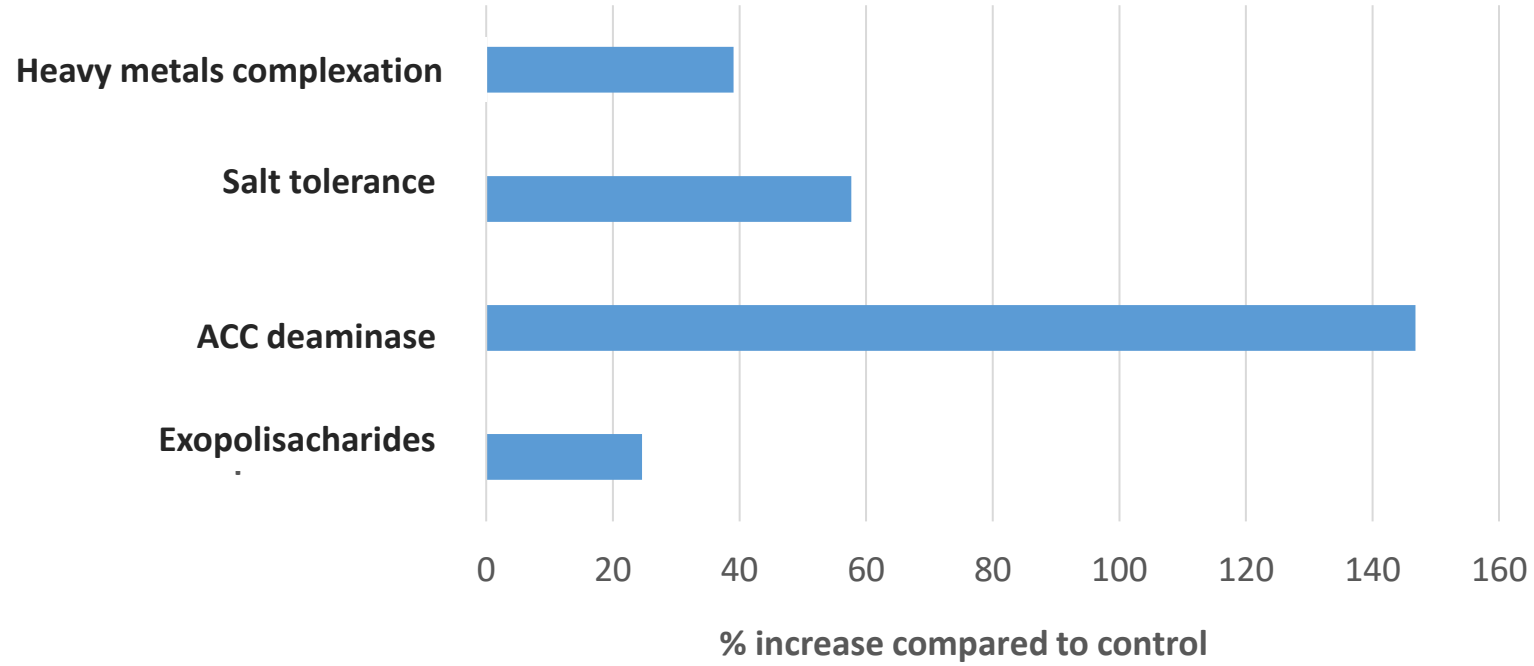


Effect of Kiplant All-grip on the microbial species related with the production of stress adaptation metabolites



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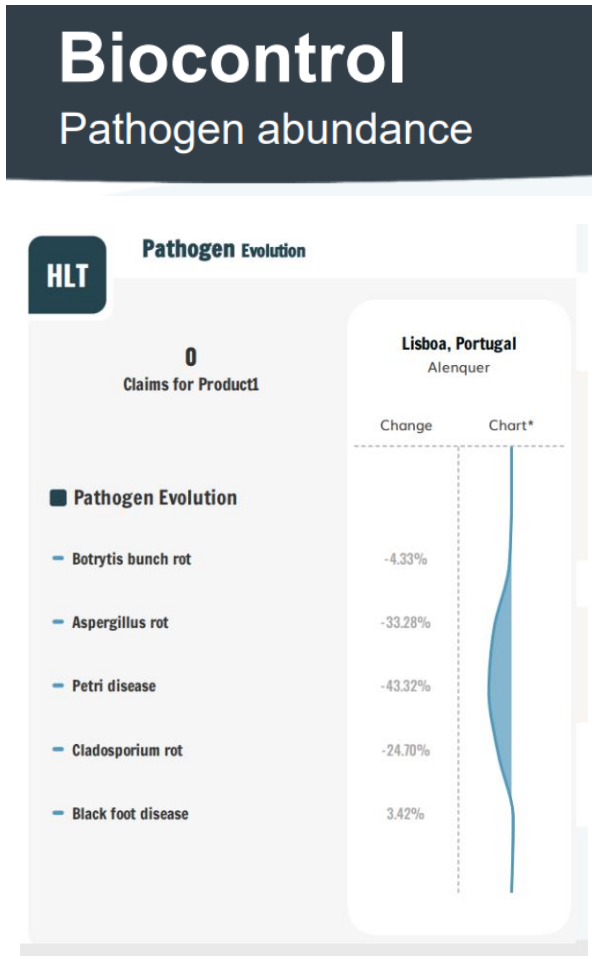
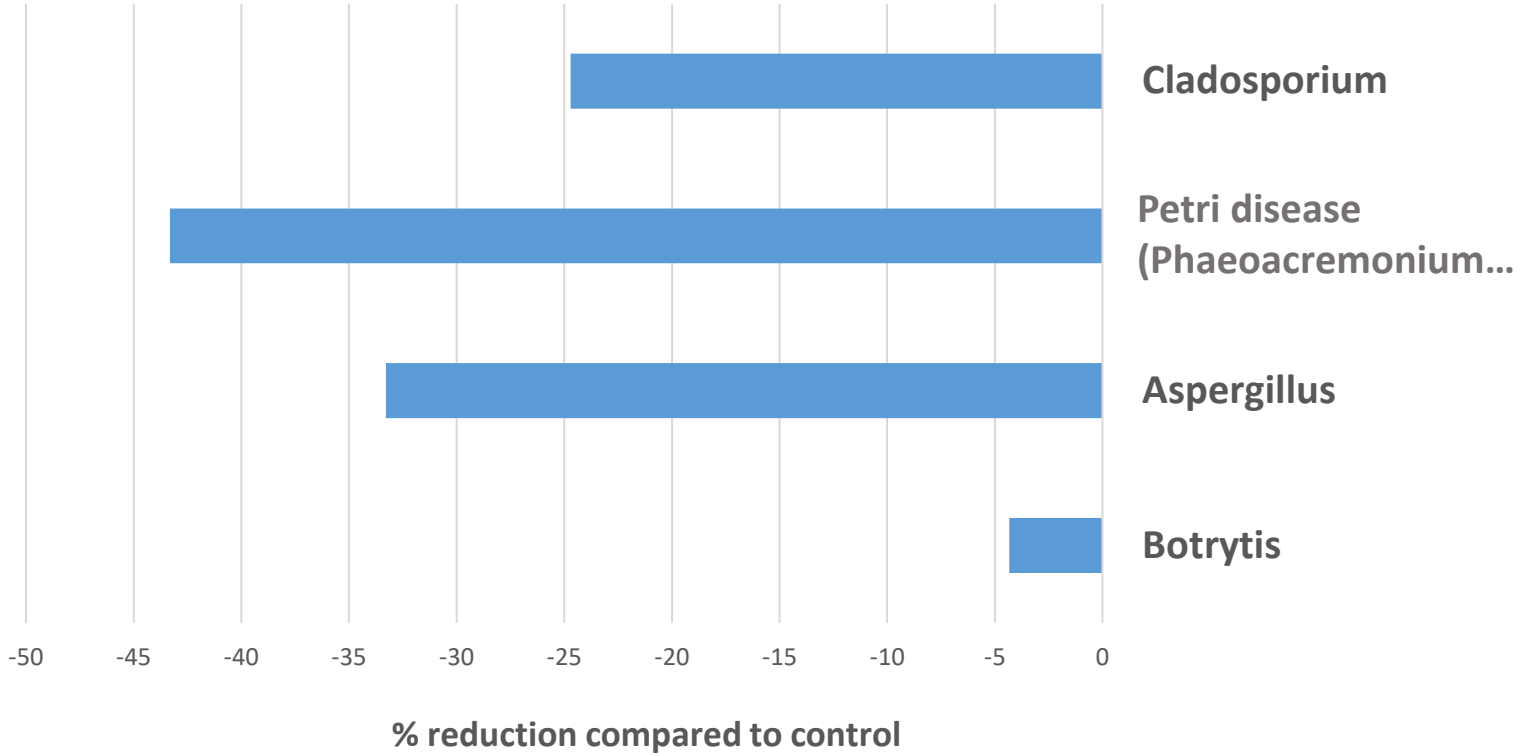


Effect of Kiplant All-grip on the reduction of microbial species related with Vineyards diseases



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Objectivo: Comparar consorcio bacteriano* contra paquetes nutricionales usados tradicionalmente por el agricultor en la zona donde se realiza la prueba

CULTIVO	Aguacate
VARIEDAD	Hass
PLANTAS	60
TECNOLOGÍA DE CULTIVO	Campo abierto
SISTEMA DE RIEGO	temporal
SISTEMA PRODUCCIÓN	suelo
RENDIMIENTO/HA	N/A
MUNICIPIO	Uruapan
ESTADO	Michoacán

Kiplant AllGrip

**B. megaterium*, >1x10^8 UFC/mL; *P. fluorescens*, >1x10^8 UFC/mL; *P. putida*, >1x10^8 UFC/mL

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Kiplant AllGrip

Tratamiento suelo	
***B. megaterium*, >1x10^8 UFC/mL;** ***P. fluorescens*, >1x10^8 UFC/mL;** ***P. putida*, >1x10^8 UFC/mL**	5l / 3000l water per application 50 litters of water per tree

Primera aplicación	**2 de septiembre 2022**
Segunda aplicación	28 de septiembre 2022

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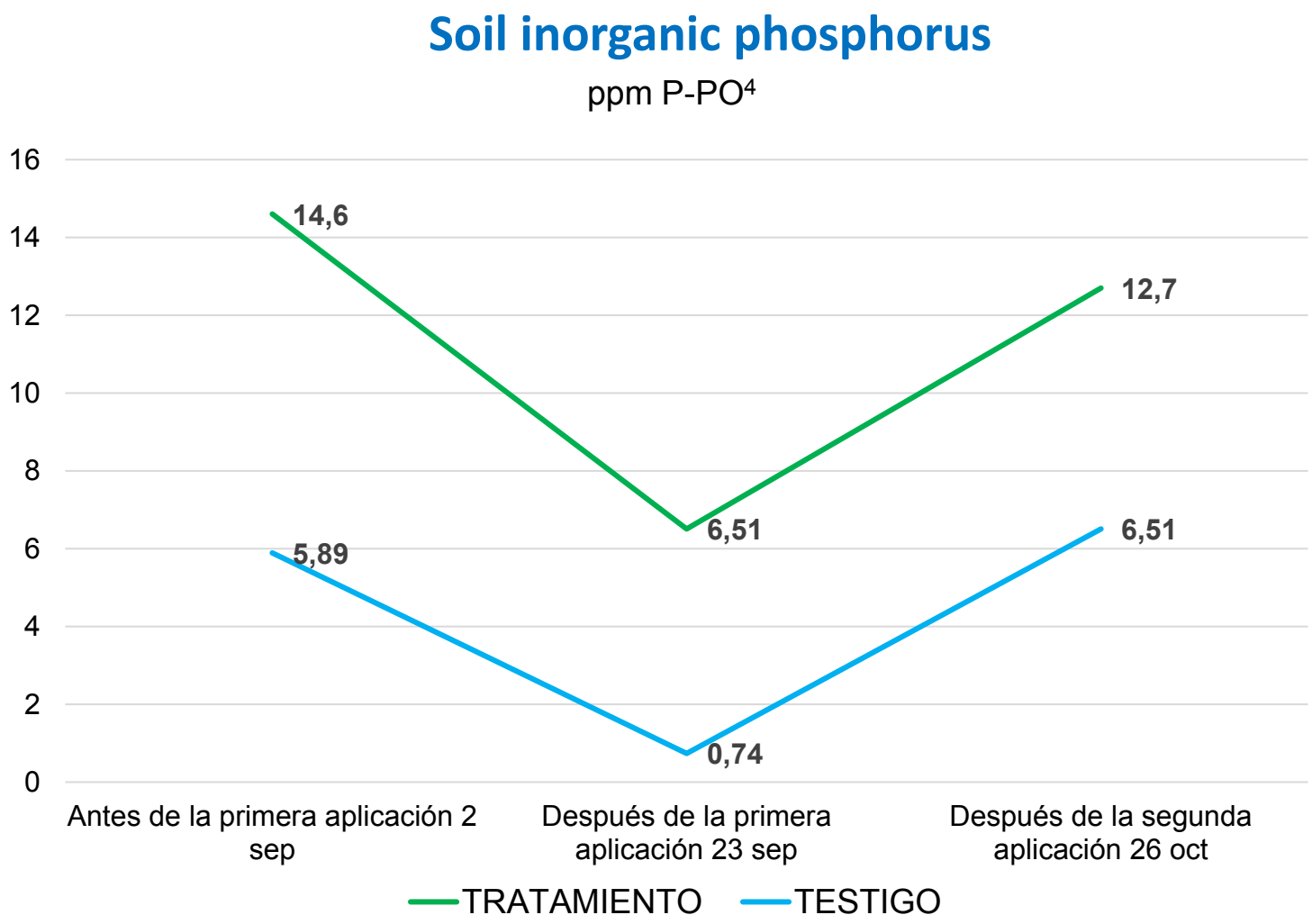

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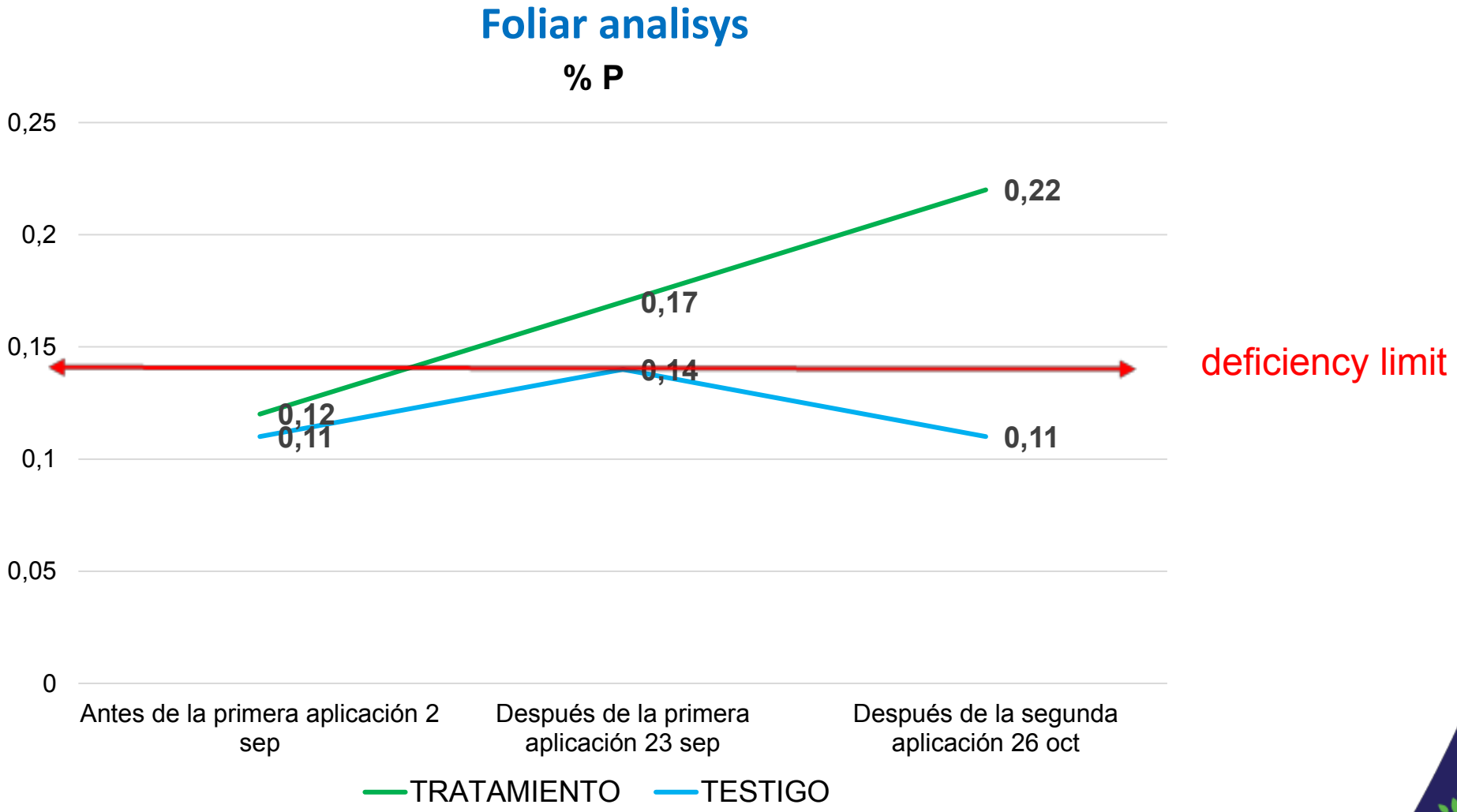

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BENEFICIAL BACTERIA ANALISYS

FOR-FP-21
Emisión: Oct-2019

FERTILIDAD DE SUELOS S. DE RL.
Poniente 6 No. 200, Ciudad Industrial, Celaya, Gto. C.P. 38010
www.fertilab.com.mx

Laboratorio de Diagnóstico Fitosanitario

ema LABORATORIO DE ENSAYO
ACREDITADO SA-1359-044/21

Kiplant AllGrip

23 DE SEPTIEMBRE		
ENSAYO	BACTERIAS	RESULT
CONTROL	*Bacillus* spp	3×10^4
	Pseudomonas spp	Non detected
TRATAMIENTO	*Bacillus* spp	3×10^5
	Pseudomonas spp	2×10^4

+ 10 X

Kiplant AllGrip

26 DE OCTOBRE		
ENSAYO	BACTERIAS	RESULT
CONTROL	*Bacillus* spp	5×10^4
	Pseudomonas spp	Non detected
TRATAMIENTO	*Bacillus* spp	3×10^6
	Pseudomonas spp	2×10^5

Negativo a bacterias fitopatogenas

0X10 9

EVALUATION OF KIPLANT ALL-GRIP IN AVOCADO

DISEÑO EXPERIMENTAL

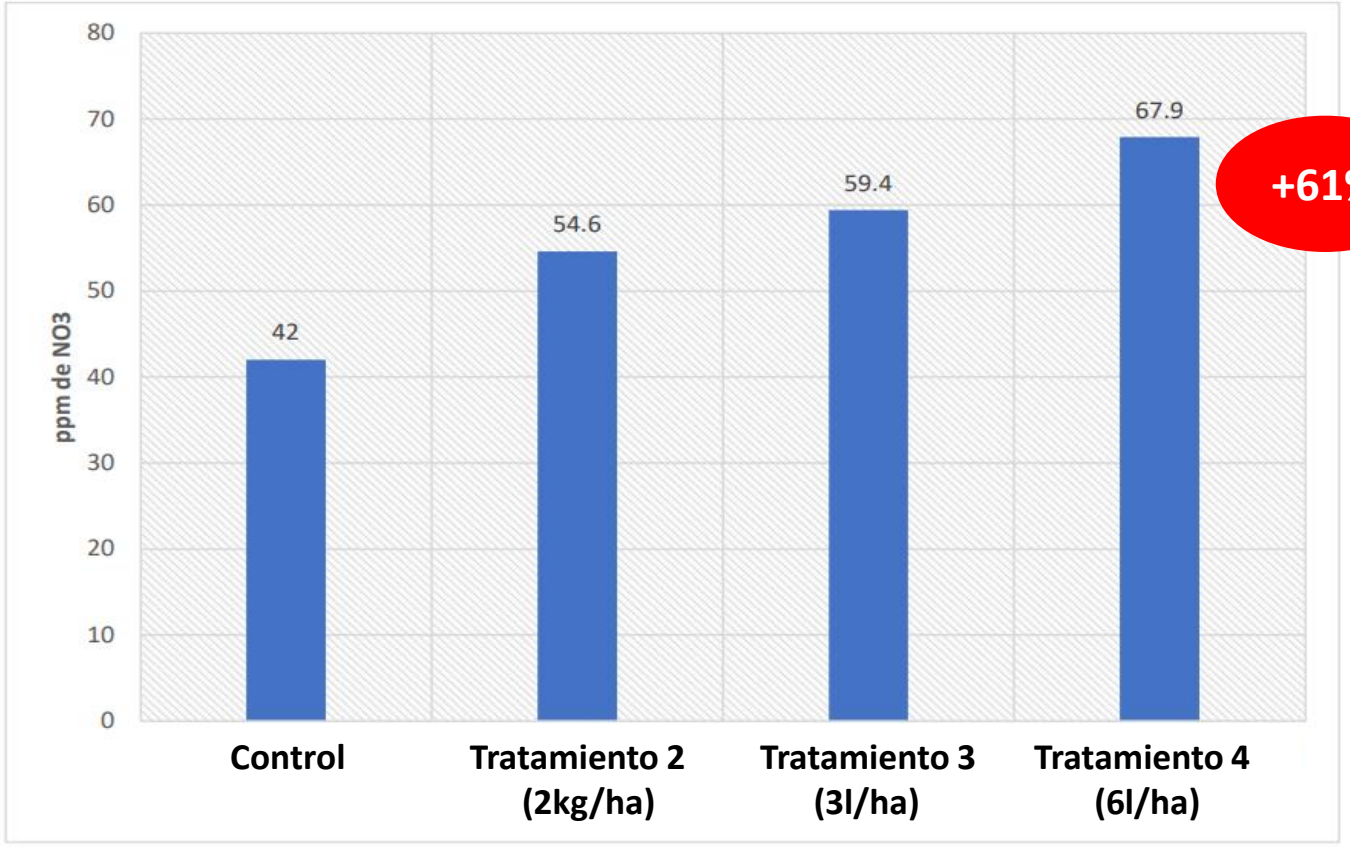
Se utilizó un diseño de bloques completos al azar con 4 tratamientos y 5 repeticiones. La unidad experimental fue un árbol de aguacate cv Hass.

TRATAMIENTOS

Tratam.	Consorcio Bacteriano	Dosis/ ha
1	Control	
2	*T. harzianum*, $1.35x10^5$ UFC/g; *P. bilaiae* + *Penicillium* spp. + *P. lilacinus*, $1.25x10^7$ UFC/g; *B. subtilis*, $1.25x10^8$ UFC/g; *A. brasilensis*, $1.25x10^5$ UFC/g	2kg
3	*B. megaterium*, $>1x10^8$ UFC/mL; *P. fluorescens*, $>1x10^8$ UFC/mL; *P. putida*, $>1x10^8$ UFC/mL	3l
4	*B. megaterium*, $>1x10^8$ UFC/mL; *P. fluorescens*, $>1x10^8$ UFC/mL; *P. putida*, $>1x10^8$ UFC/mL	6l

RESULTADOS

Nitratos



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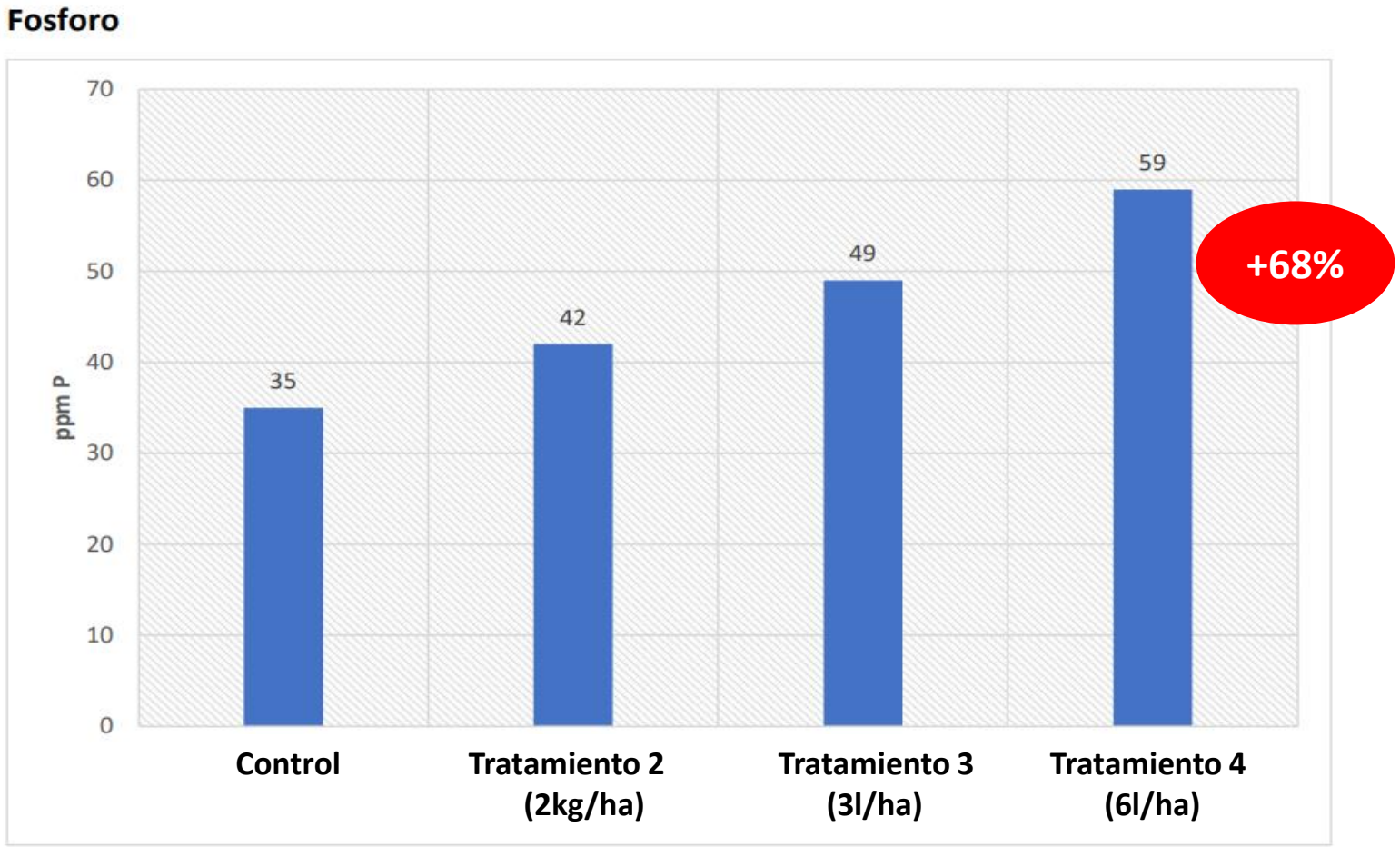

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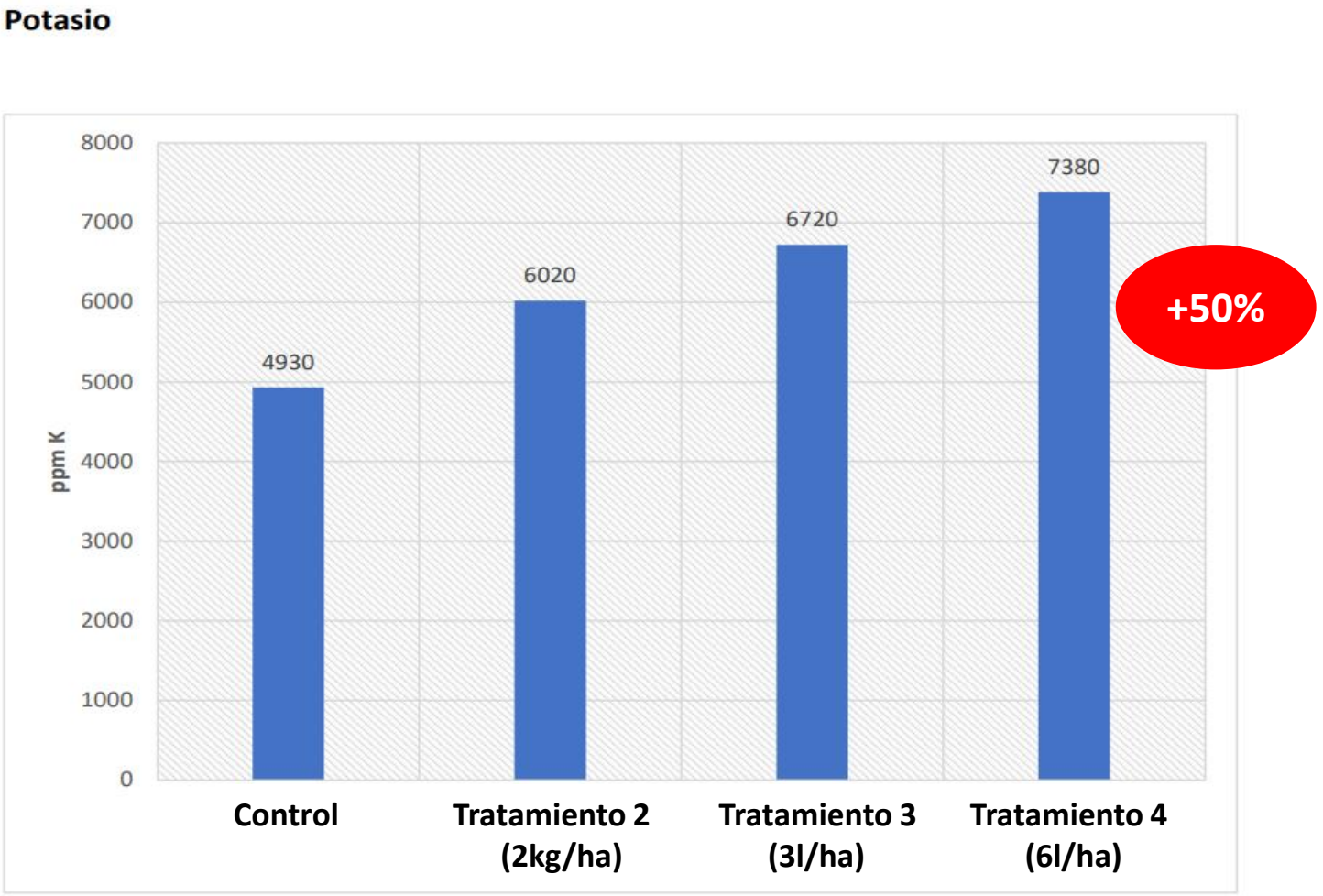

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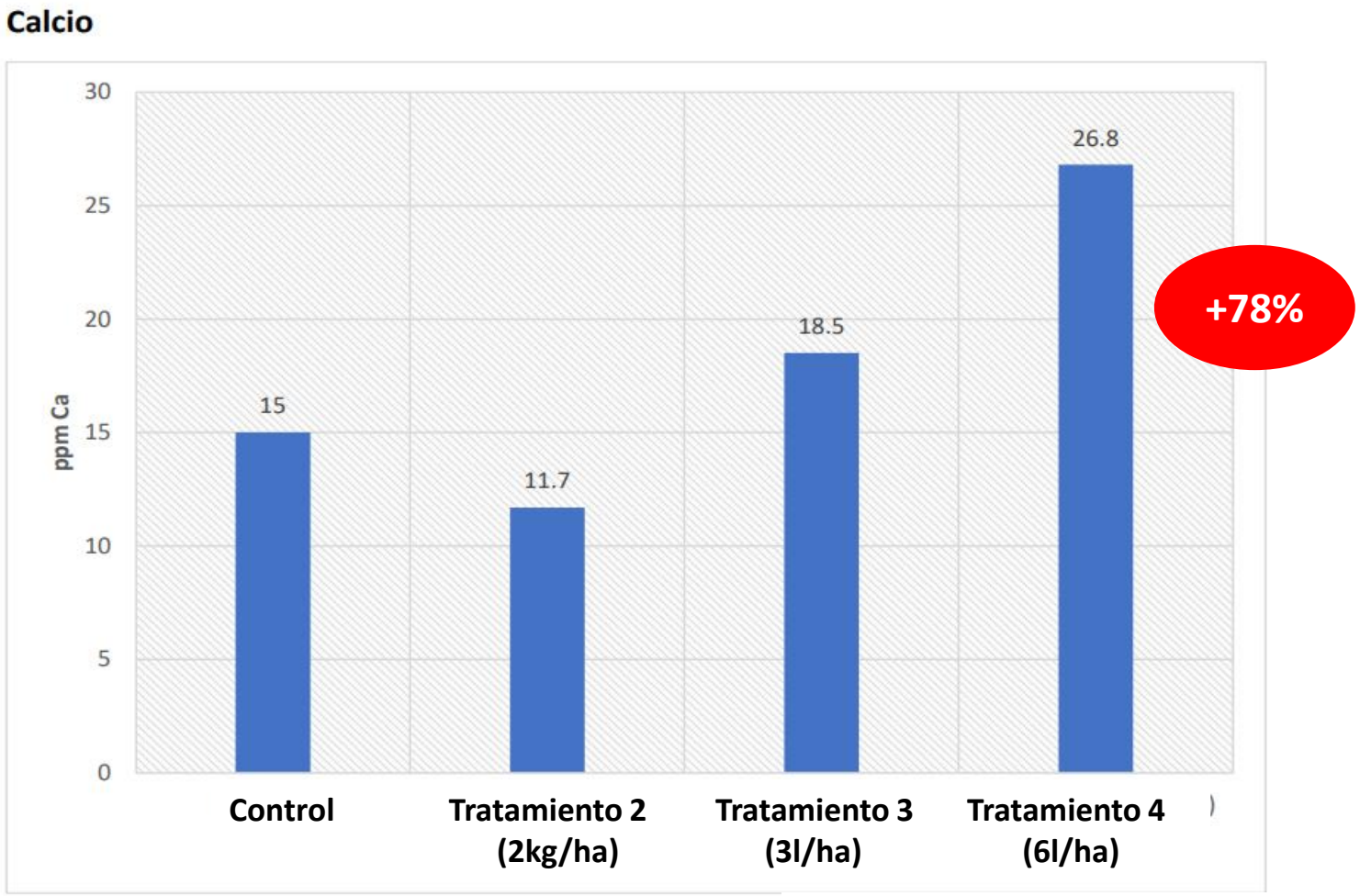

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The need for biofertilizers: a market perspective

Counting flowers and fruits

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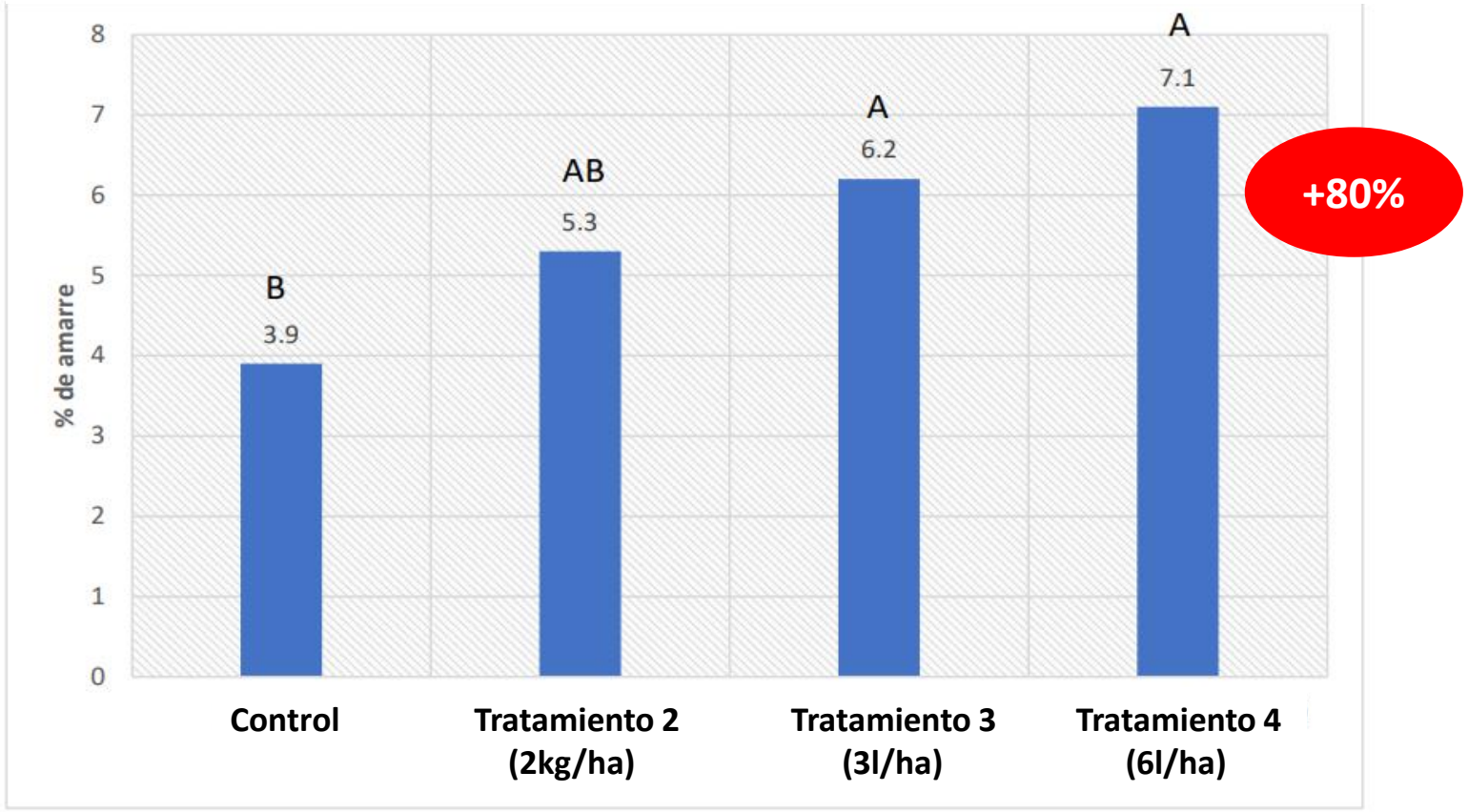
The need for biofertilizers: a market perspective

Initial fruit setting (fruits 0,5-1cm)



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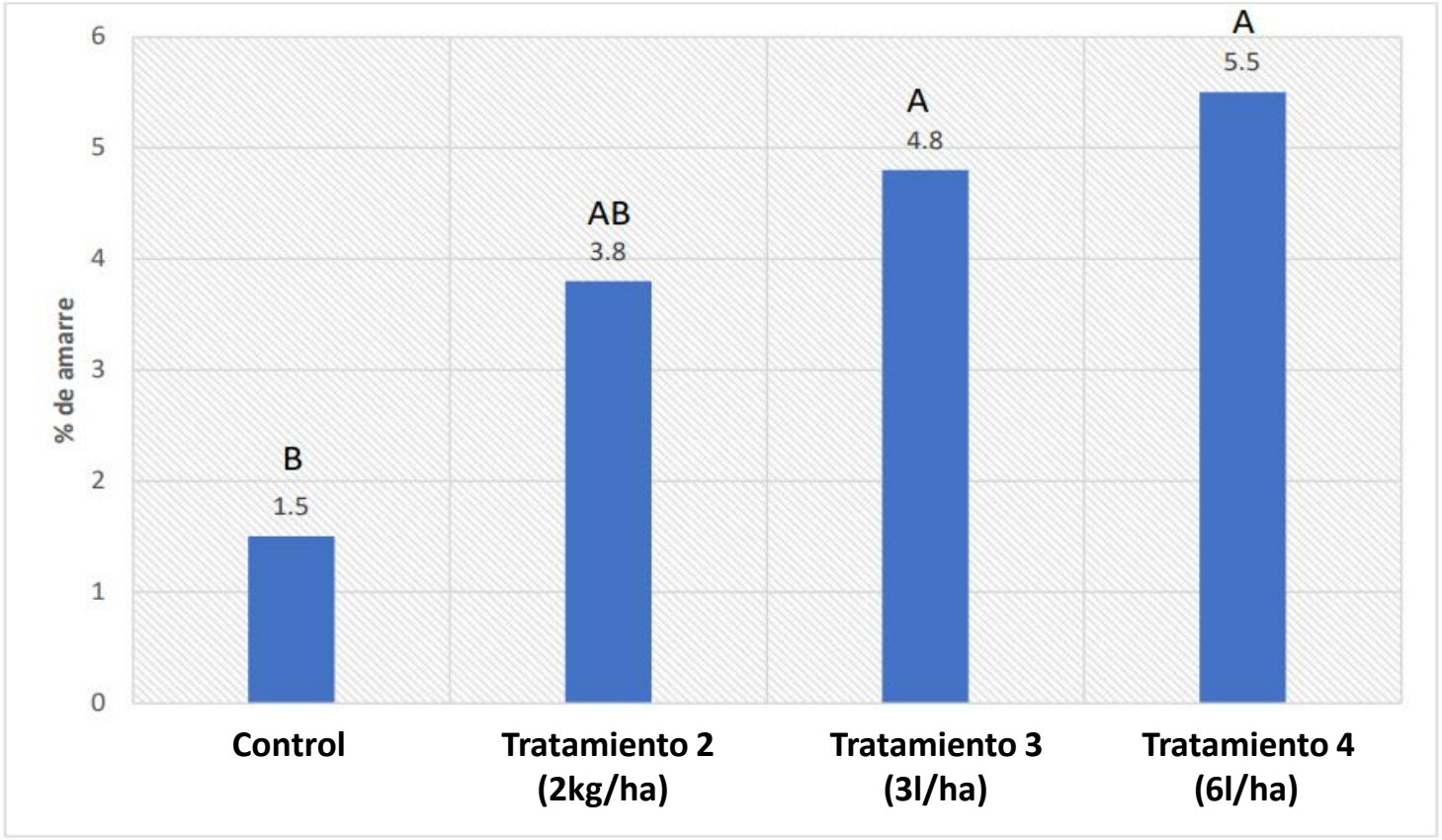
The need for biofertilizers: a market perspective

Final fruit setting (fruits 3-5cm)



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The need for biofertilizers: a market perspective

EFFECT ON SOIL MICROBIOME

Tratamento	*Trichoderma* (UFC/g)
Controlo	3.9×10^3
T. harzianum, 1.35×10^5 UFC/g; *P. bilaiae* + *Penicillium* spp. + *P. lilacinus*, 1.25×10^7 UFC/g; *B. subtilis*, 1.25×10^8 UFC/g; A. brasilense, 1.25×10^5 UFC/g	1×10^3
Kiplant AllGrip — *B. megaterium*, $>1 \times 10^8$ UFC/mL; *P. fluorescens*, $>1 \times 10^8$ UFC/mL; *P. putida*, $>1 \times 10^8$ UFC/mL (3l/ha)	1.9×10^3
Kiplant AllGrip — *B. megaterium*, $>1 \times 10^8$ UFC/mL; *P. fluorescens*, $>1 \times 10^8$ UFC/mL; *P. putida*, $>1 \times 10^8$ UFC/mL (6l/ha)	9×10^3

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EFFECT ON SOIL MICROBIOME

Tratamento	*Fusarium* spp. (UFC/g)
Controlo	1.51×10^4
T. harzianum, 1.35×10^5 UFC/g; *P. bilaiae* + *Penicillium* spp. + *P. lilacinus*, 1.25×10^7 UFC/g; *B. subtilis*, 1.25×10^8 UFC/g; A. brasilense, 1.25×10^5 UFC/g	1.24×10^4
Kiplant AllGrip — *B. megaterium*, $>1 \times 10^8$ UFC/mL; *P. fluorescens*, $>1 \times 10^8$ UFC/mL; *P. putida*, $>1 \times 10^8$ UFC/mL (3l/ha)	1.43×10^4
Kiplant AllGrip — *B. megaterium*, $>1 \times 10^8$ UFC/mL; *P. fluorescens*, $>1 \times 10^8$ UFC/mL; *P. putida*, $>1 \times 10^8$ UFC/mL (6l/ha)	8.6×10^3

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42% of the globe
3000M people

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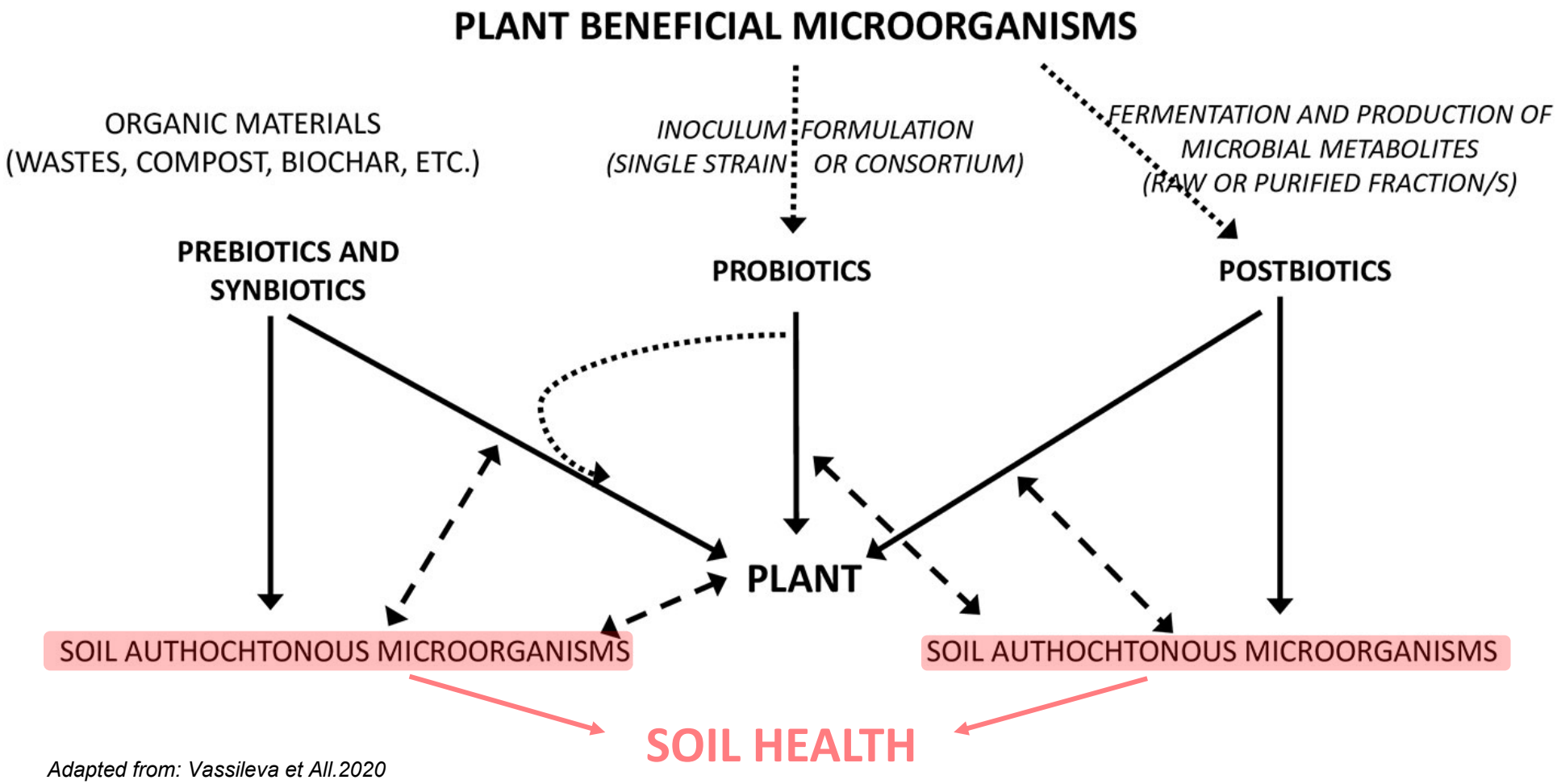
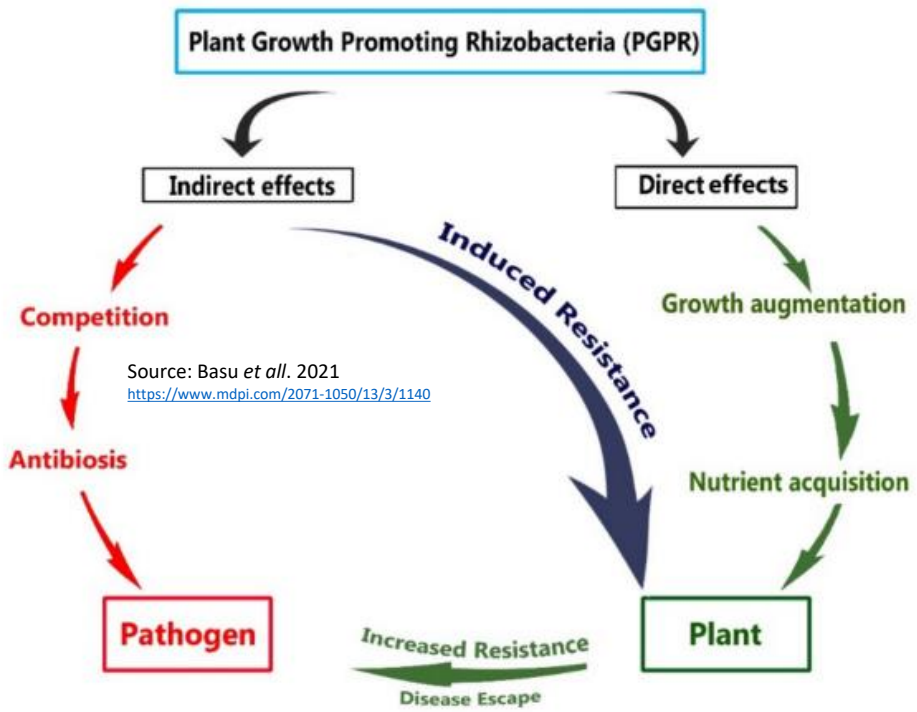


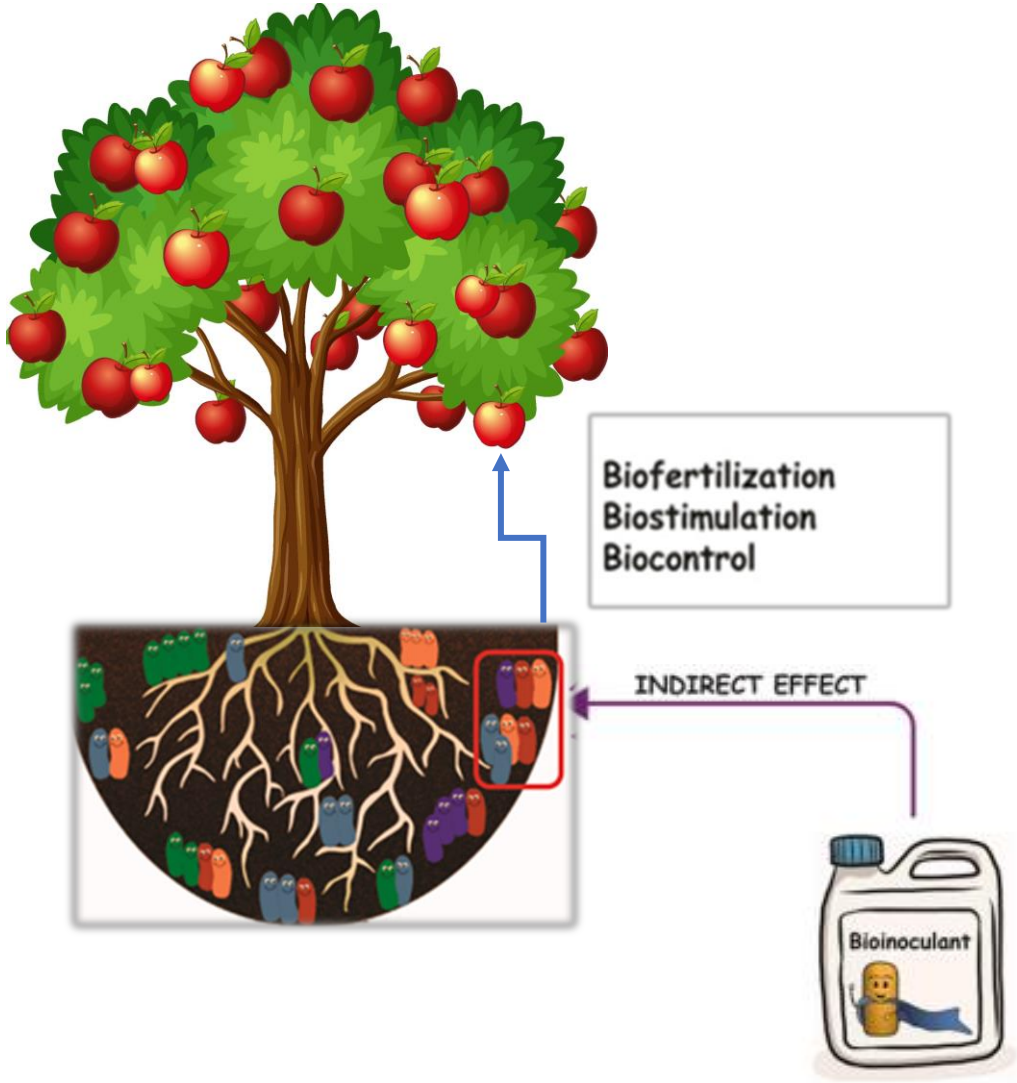
Adapted from: Vassileva et All.2020

Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective



Source: Basu *et all*. 2021
https://www.mdpi.com/2071-1050/13/3/1140



EVALUACIÓN DE CONSORCIOS MICROBIANOS PARA EL CONTROL DE LA PUDRICIÓN RADICULAR CAUSADA POR *Phytophthora cinnamoni* EN AGUACATE

M.C. BRAULIO ALBERTO LEMUS SORIANO
Facultad de Agrobiología - Universidad Michoacana de San Nicolás de Hidalgo
Uruapan, Michoacán, México.

Bacterial consortia against *Phytophtora cinnamoni* on avocado

Treat.	Bacterial consortia	Aplication	Dose /ha
1,2	*P. tinctrius*, $1x10^6$; UFC/g, *G. intraradices*, $1x10^3$ UFC/g; *A. brasilense*, $1x10^6$ UFC/g	1-Pre inoc, 2-Post inoc	2Kg
3,4	*T. harzianum*, $1.35x10^5$ UFC/g; *P. bilaiae* + *Penicillium* spp. + *P. lilacinus*, $1.25x10^7$ UFC/g; *B. subtilis*, $1.25x10^8$ UFC/g; A. brasilense, $1.25x10^5$ UFC/g	3-Pre inoc, 4-Post inoc	2kg
5,6	*B. megaterium*, $>1x10^8$ UFC/mL; *P. fluorescens*, $>1x10^8$ UFC/mL; *P. putida*, $>1x10^8$ UFC/mL	5-Pre inoc, 6-Post inoc	3l Kiplant AllGrip
7,8	*B. subtilis*, $2.1x10^9$ UFC/mL; *B. megaterium*, $2.1x10^9$ UFC/mL; *B. licheniformis*, $2.1x10^9$ UFC/mL; *Azotobacter*, $2.1x10^9$ UFC/mL; *P. fluorescens*, $2.1x10^9$ UFC/mL	7-Pre inoc, 8-Post inoc	1kg
9,10	Paenibacillus, $>1x10^8$ UFC/mL; *B. amyloliquefasciens*, $>1x10^8$ UFC/mL, *B. megaterium*, $>1x10^8$ UFC/mL; *B. subtillis*, $>1x10^8$ UFC/mL, *B. licheniformis*, $>1x10^8$ UFC/mL; *B. oceanisediminis*, $>1x10^8$ UFC/mL; *B. safensis*, $>1x10^8$ UFC/mL; *B. coagulans*, $>1x10^8$ UFC/mL, *B. circulans*, $>1x10^8$ UFC/mL	9-Pre inoc, 10-Post inoc	2l
11	Controlo	----	---

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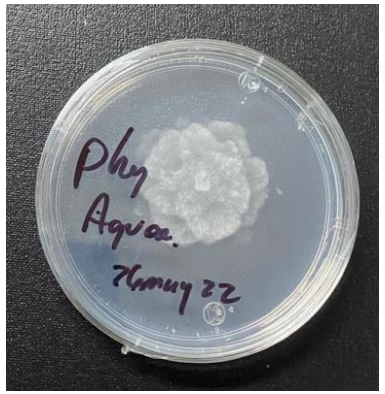

Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective

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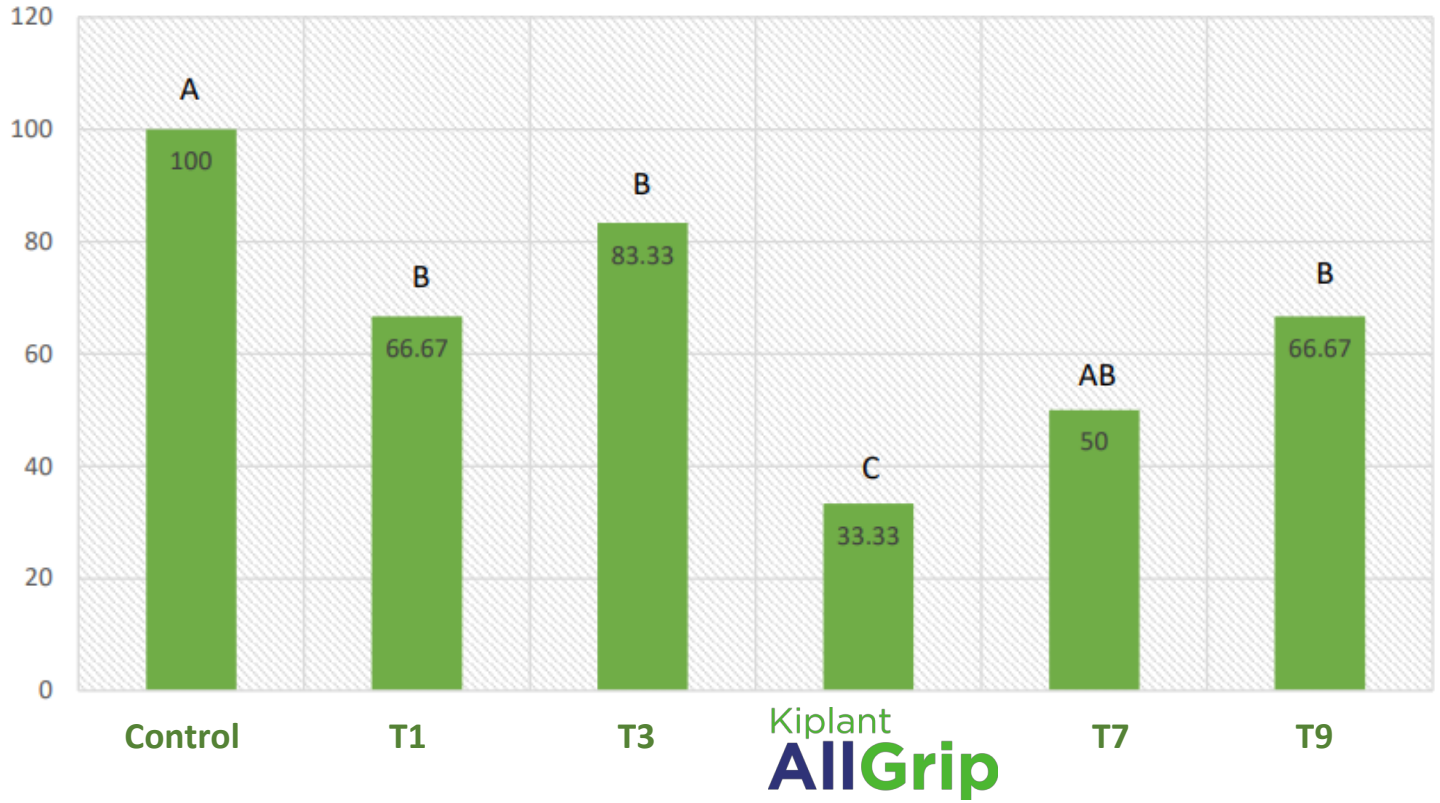
Facultad de Agrobiología - Universidad Michoacana de San Nicolás de Hidalgo

Disease incidence– Pre-inoculation



Kiplant AllGrip

Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective

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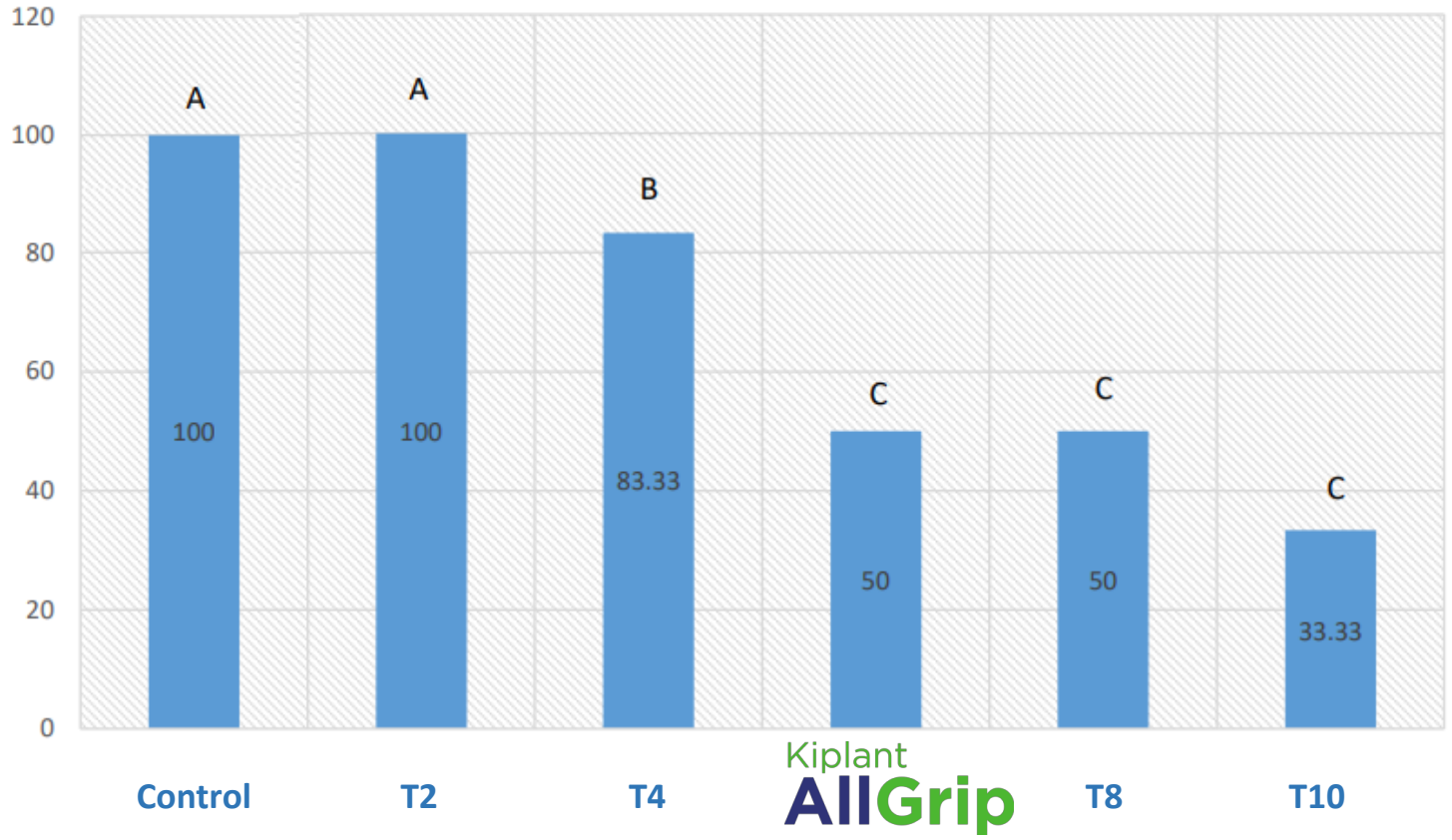
Disease incidence – Post -inoculation



Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective

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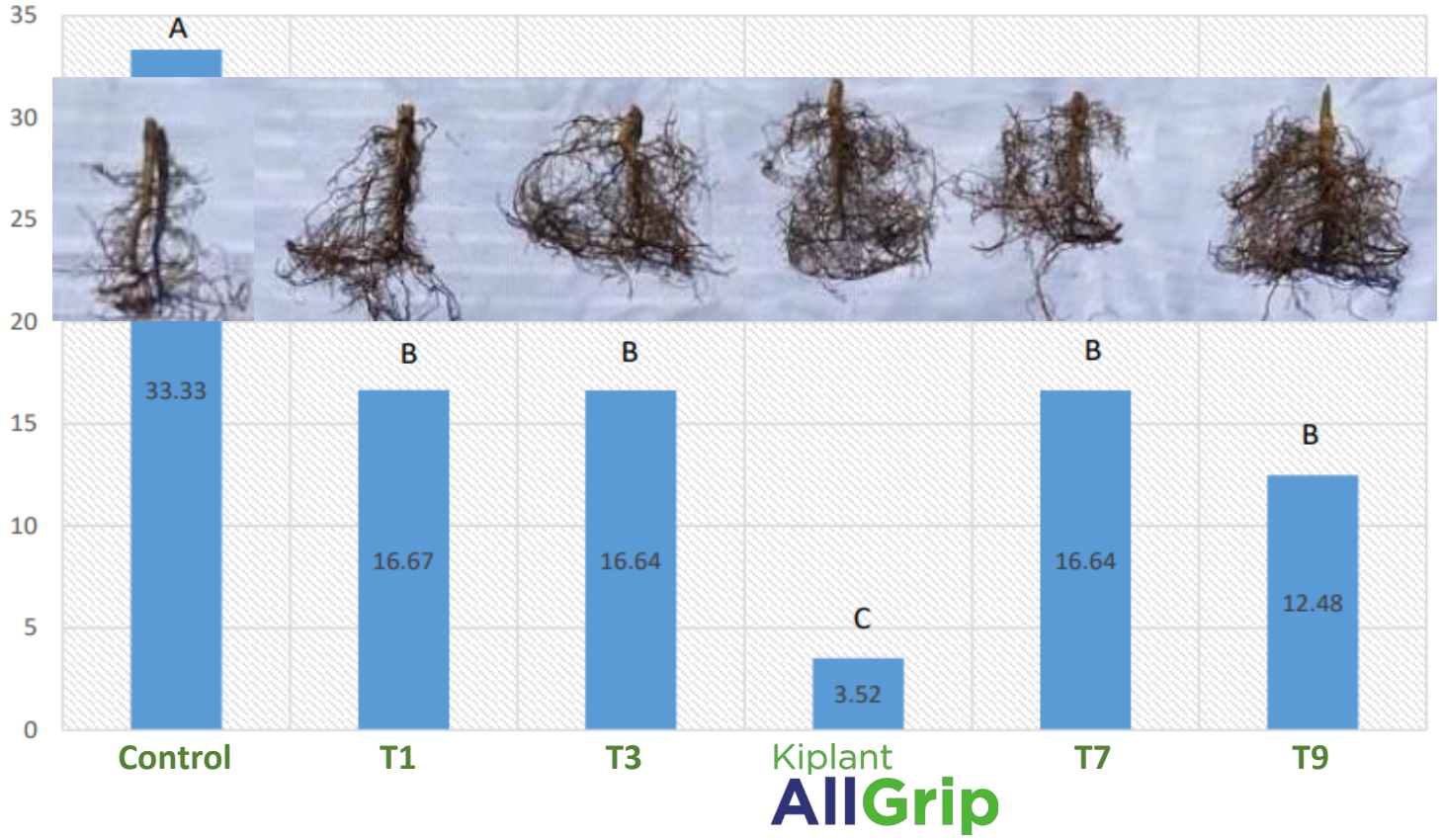
Disease severity– Pre-inoculation



Combining biofertilizer application with precision agriculture technologies

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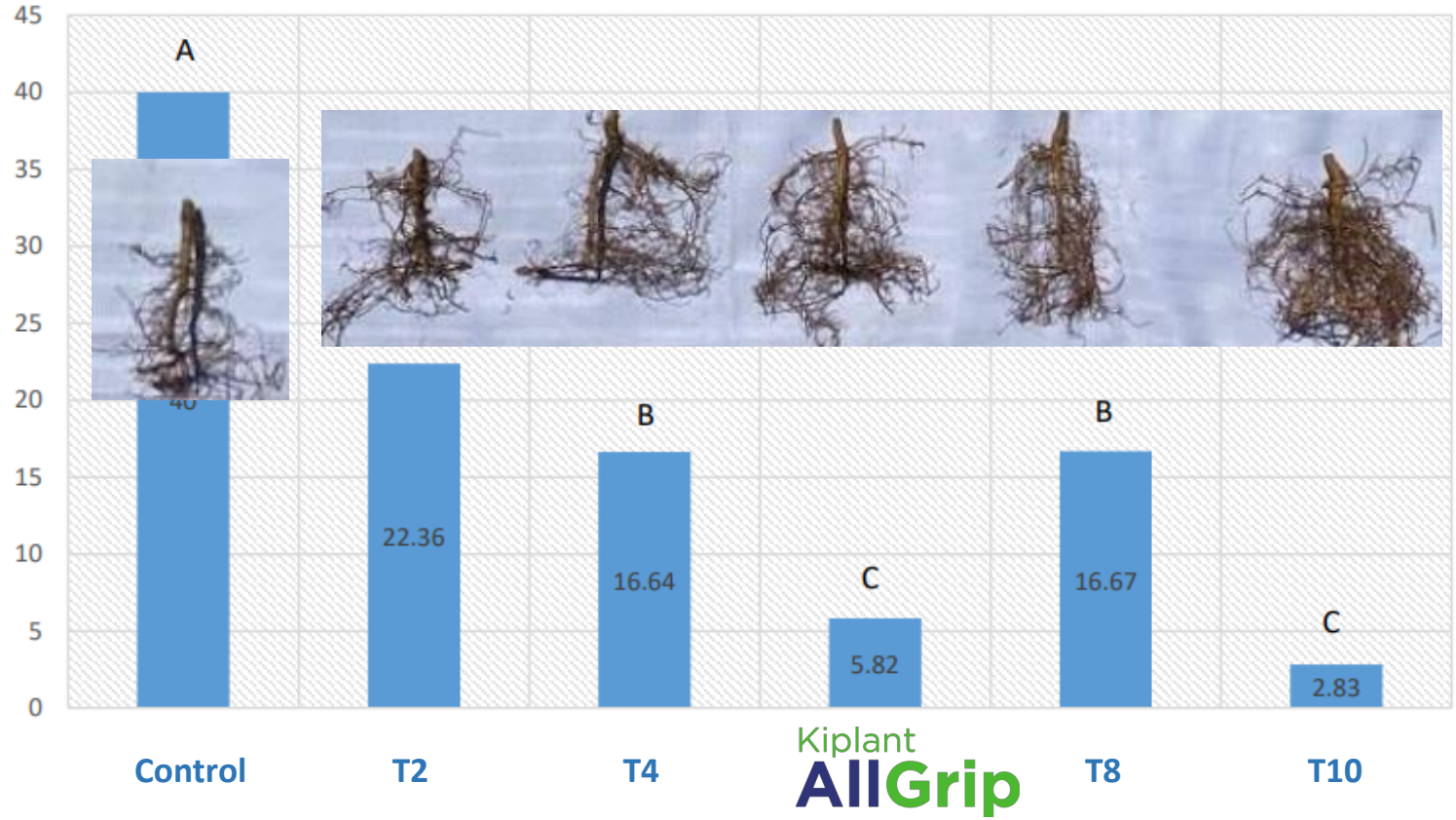
Disease severity – Post -inoculation



O nascer de uma nova agricultura

Combining biofertilizer application with precision agriculture technologies

The need for biofertilizers: a market perspective

SUSTAINABILITY…

HEALTH…

CONSUMERS…

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The need for biofertilizers: a market perspective

gaia HERBS

~140ha

2,556

Amount of CO_2 sequestered through regenerative farming practices

Maintaining a healthy soil microbiome isn't just important for the plants, it's critical for the environment. Soil high in organic matter with healthy microbial activity helps to trap excess carbon that would otherwise contribute to climate change. And as soil health improves, it is able to capture even more carbon in the atmosphere. This past year on our farm, we were able to capture over 2,490 tons of CO2 in the soil by supporting its microbiome. This is equivalent to the emissions from the electricity of 422 homes in a year. Leonard shared, "We farm almost as much carbon as we do all of the crops that grow on our farm. It's satisfying to look at our soil tests year after year and see that we are sequestering even more carbon."

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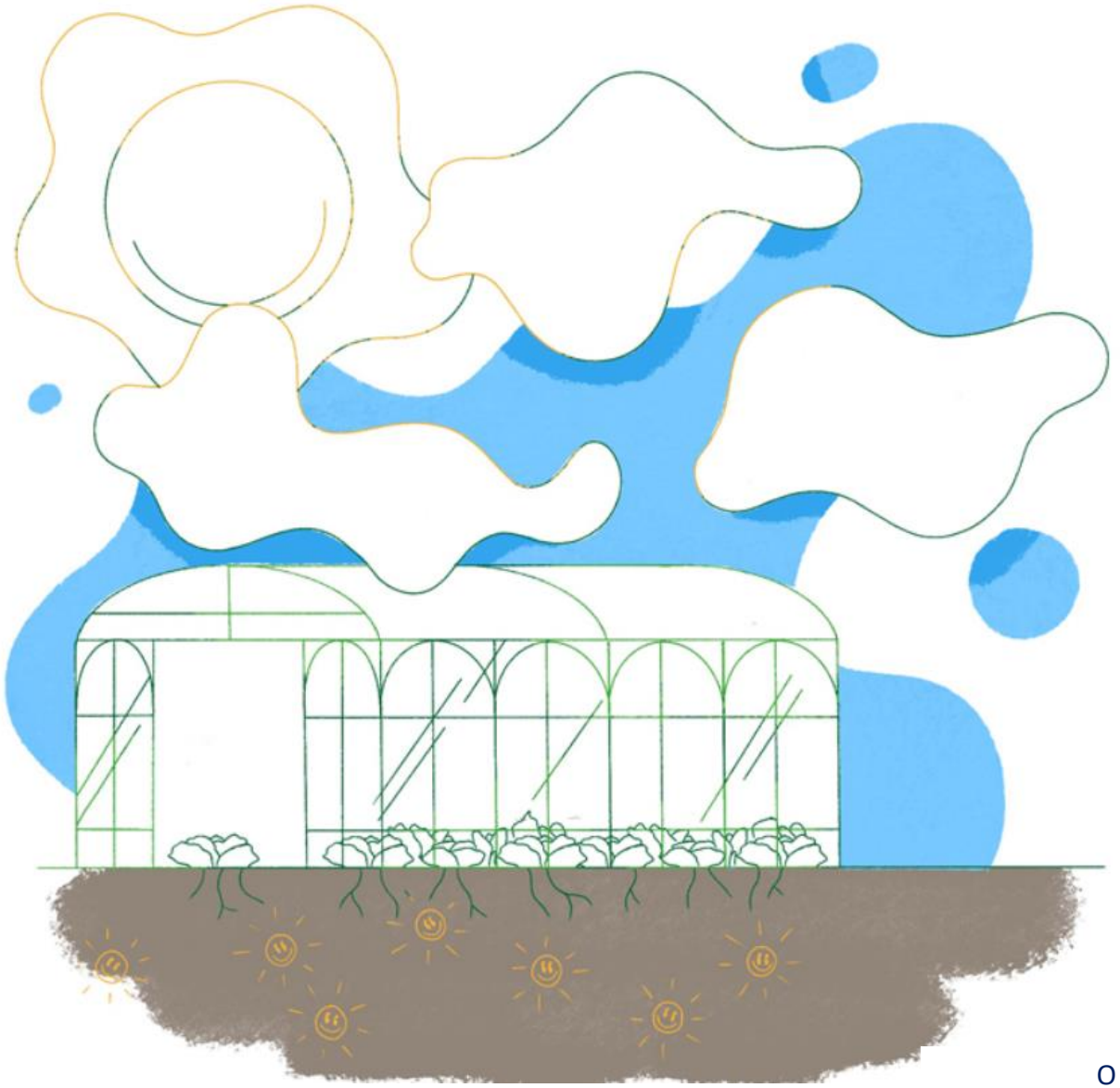
AZIENDA AGRICOLA GAMBARO
Coltiviamo con la Natura

agricoltura simbiotica

10ha
8ha



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The need for biofertilizers: a market perspective

Symbiosis

Owner Paolo Gambara explains that new growing processes like symbiotic horticulture are used to find a natural balance. "Symbiosis uses microorganisms that benefit healthy plant growth to improve the soil. Analyzing zero-residue products show zero chemical molecules besides phytosanitary substances permitted in organic farming, as long as they're within the maximum 50% RMA limits for that particular plant-based

Gambaro is certified under the Zero Residue protocol. That means their products have legally permitted levels of chemicals below the analytical limit of determination (0.01 ppm) and residues of pesticides allowed in organic farming, per Annex I of EU Regulation 2021/1165, within the 50% limit of the maximum residue limit.

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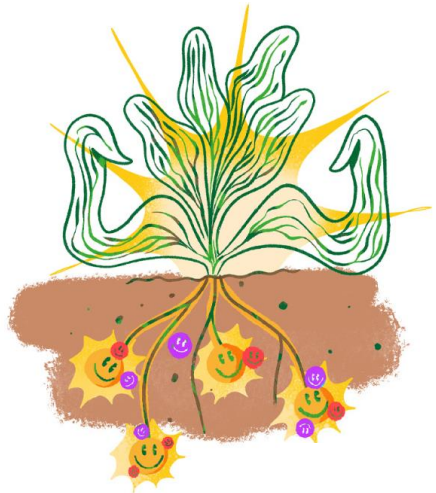
Symbiotic Agriculture

Symbiotic Agriculture is an innovative cultivation technique that aims to improve the biodiversity of the soil, bringing a greater benefit not only to the products, but also to animals and men. It is based on the concept of symbiotic association: we grow our crops with completely natural products, creating a collaboration between microorganisms – such as fungi, bacteria and yeasts – with plant roots. In this way, we manage to produce stronger and healthier plants, obtaining products with a high nutritional value. We work to nourish both the brain, allowing our customers to be aware of the fact that they eat fresh and healthy products, and the intestine, since our products can help improve the quality of the intestinal flora and microbiome, and, consequently, become functional to the immune system response.



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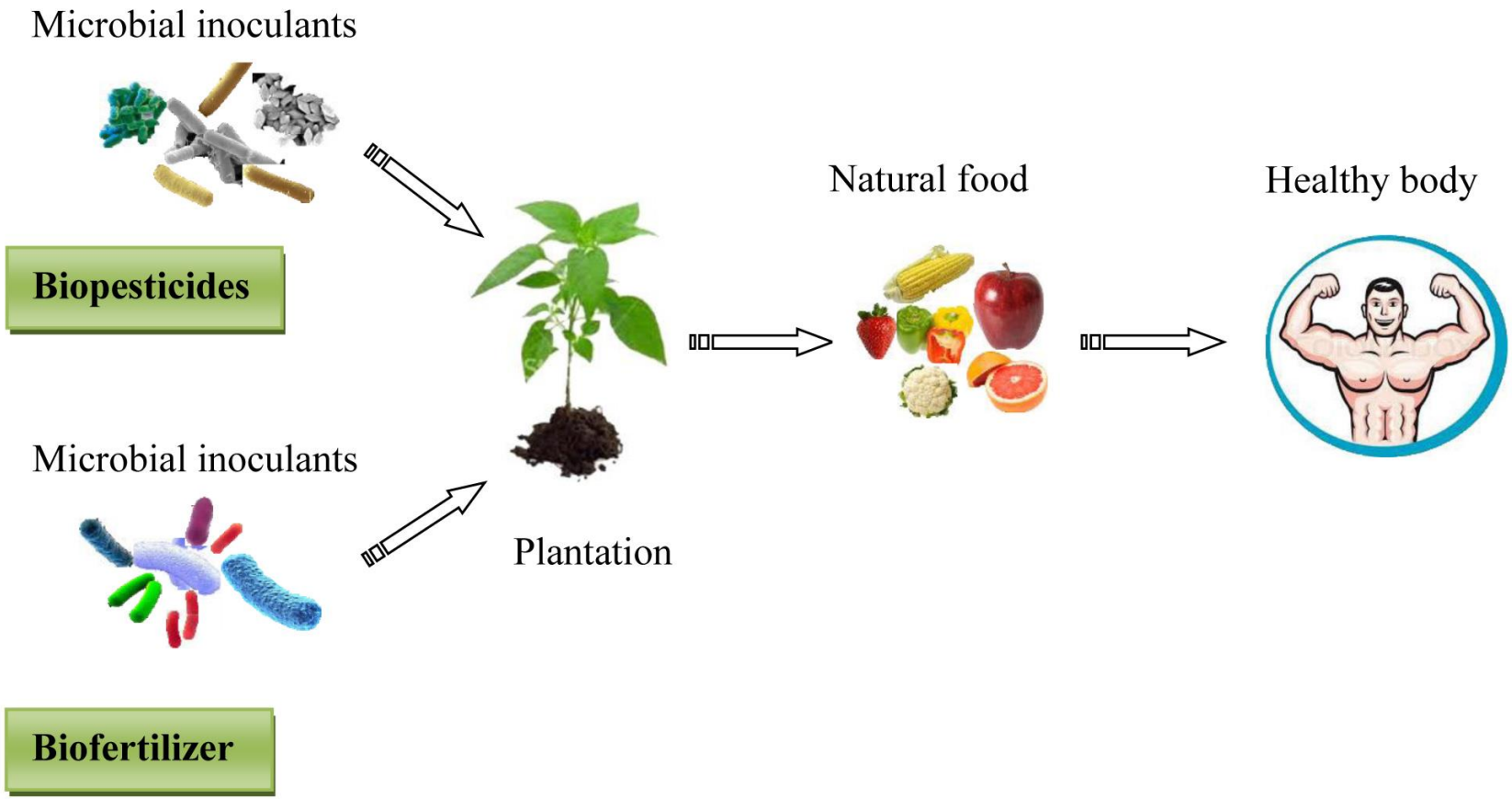

Source: **Seenivasagan and Babalola (2021)**
https://www.mdpi.com/2079-7737/10/11/1111