

PF-MA-03

SIMBA: Design, formulation and optimization of Plant Growth-Promoting Microbes (PGPMs) for their use as microbial consortia inoculants

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miCROPe 2019 - 4th December 2019, Vienna

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 818431 (SIMBA). This output reflects only the author's view and the European Union cannot be held responsible for any use that may be made of the information contained therein.

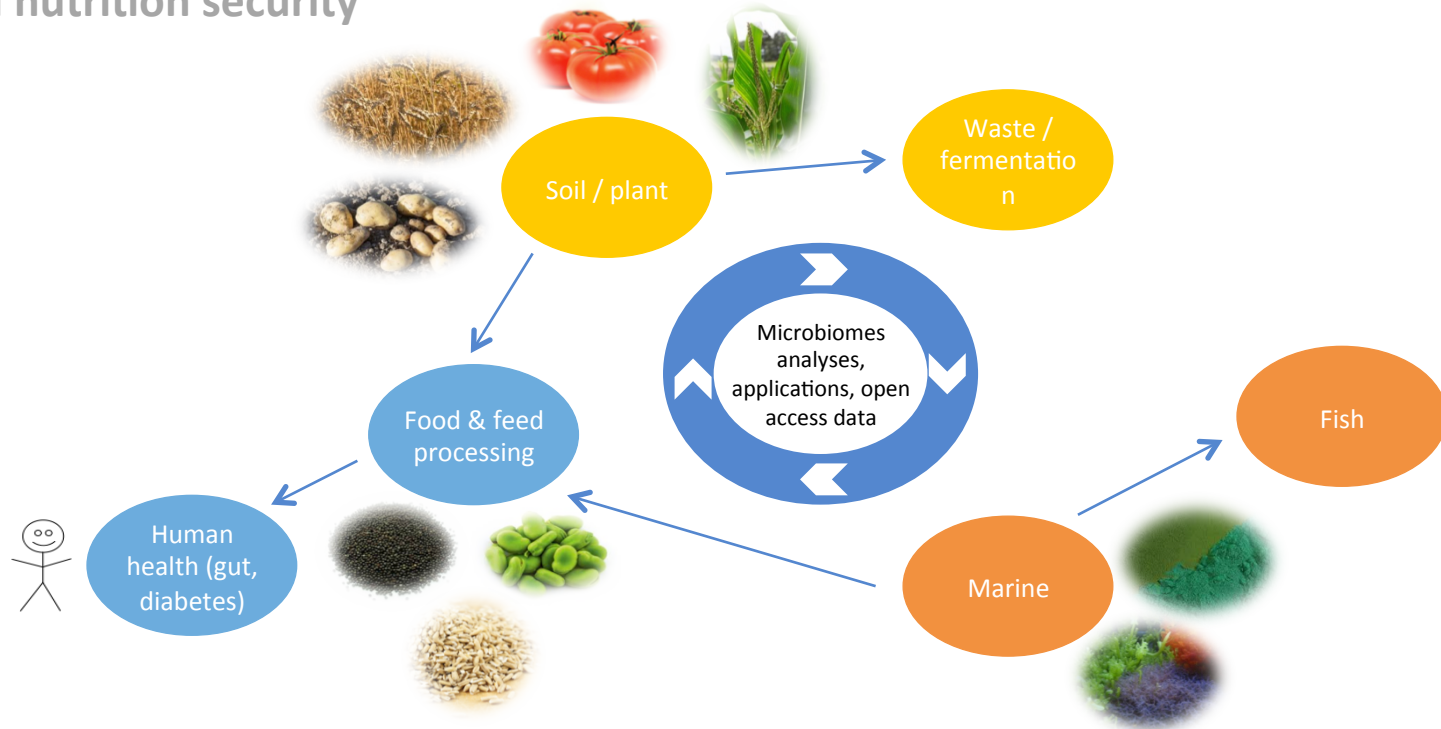
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The microbiome-based solution



SIMBA is a European innovation project, funded through Horizon 2020, which provides a holistic and innovative approach to the development of microbial solutions to increase food and nutrition security



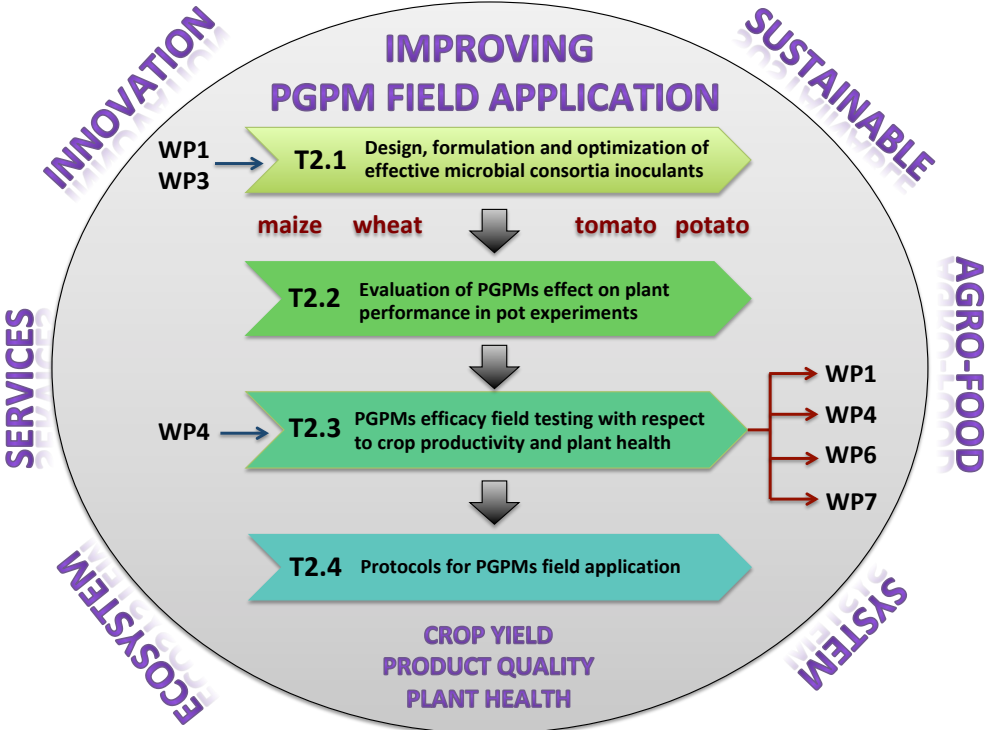
Work Package 2 of SIMBA project is aimed to exploit the full potential of PGPMs for sustainable crop production by optimizing the efficacy and reproducibility of field applications.

AIM OF THE PRESENT WORK:

Identify efficient microbial formulations to be applied as bioinoculants in arable crops in Italy and Germany, i.e. **WHEAT, MAIZE, POTATO and TOMATO**

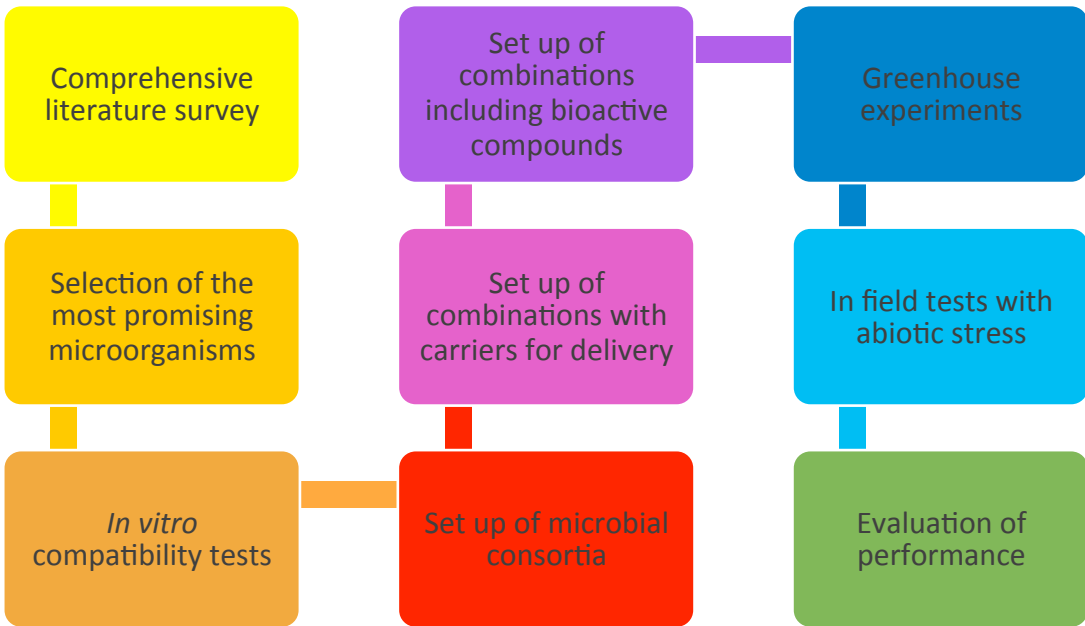


- ✓ To improve soil fertility and functionality
- ✓ To enhance plant resistance to abiotic and biotic stresses
- ✓ To improve plant productivity for the sustainable used of soil in different European farming system



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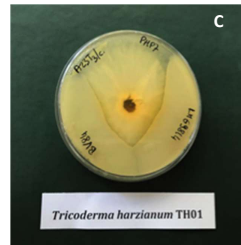
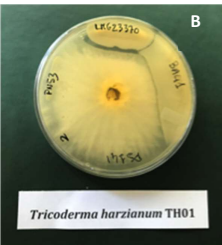
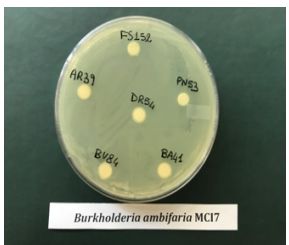
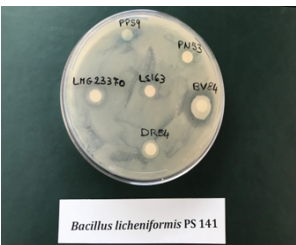
Experimental Procedure



Selected PGPMs

Microorganism	Strain	Origin	Country of isolation	Properties
<i>Acaulospora marroviae</i>	CL290	Rhizosphere	STATI UNITI	PGP
<i>Agrobacterium radiobacter</i>	AR 39	soil near peach tree	Ascoli Piceno, IT	biocontrol / PGP
<i>Azospirillum brasilense</i>	CD/ATCC 29710	<i>Cynodon dactylon</i> rhizosphere	USA	N-fixation
<i>Azospirillum brasilense</i>	NCCB 78036	soil under soy field	India	N-fixation
<i>Azospirillum lipoferum</i>	CRT1	field grown maize	FR	N-fixation
<i>Bacillus chroococcum</i>	700	soil	South IT	Nitrogen fixation
<i>Azotobacter chroococcum</i>	DSM 2286	unknown	unknown	Nitrogen fixation
<i>Azotobacter chroococcum</i>	LS132	Rhizosphere	South IT	N-fixation
<i>Azotobacter chroococcum</i>	LS163	Rhizosphere	South IT	N-fixation
<i>Azotobacter chroococcum</i>	S-5	unknown	Iran	N-fixation
<i>Azotobacter vinelandii</i>	DSM 2289	unknown	unknown	N-fixation
<i>Bacillus</i> sp.	BV84	Grape leaves	Ascoli Piceno, IT	biocontrol/PGP
<i>Bacillus amyloquefaciens</i>	BA41	Wheat rhizosphere	Ascoli Piceno, IT	biocontrol/PGP
<i>Bacillus amyloquefaciens</i>	FZ842	plant pathogen infested soil	DE	biocontrol/PGP
<i>Bacillus amyloquefaciens</i>	LMG 9814	soil	UK	alpha-amylase, alpha-glucosidase, iso-amylase production
<i>Bacillus atrophaeus</i>	AB102A		Berlin, DE	PGP
<i>Bacillus licheniformis</i>	PS141	Rhizosphere	South IT	Indole acetic acid (IAA) production
<i>Bacillus megaterium</i>	M3	rice	unknown	P-solubilisation
<i>Bacillus megaterium</i>	PMC 1855	unknown	unknown	P-solubilisation
<i>Bacillus pumilus</i>	LMG 24415	soil	Ecuador	PGP
<i>Bacillus simplex</i>	R49538	unknown	Ecuador	PGP/IAA production
<i>Bacillus subtilis</i>	FZ824 WG		Berlin, DE	PGP
<i>Bacillus subtilis</i>	LMG 23370	Forest soil	India	PGP/ biocontrol against <i>Rhizoctonia solani</i>
<i>Bacillus subtilis</i>	LMG 24418	soil	Ecuador	PGP
<i>Bacillus subtilis</i>	OSU-142	pepper	unknown	N-fixation, biocontrol
<i>Burkholderia ambifaria</i>	MC17	Maize rhizosphere	Lazio, IT	PGP
<i>Burkholderia ambifaria</i>	PHP7/ LMG 11351	Maize rhizosphere	FR	PGP
<i>Gigaspora gigantea</i>	PA125	Rhizosphere	STATI UNITI	PGP
<i>Gigaspora rosea</i>	NY328A	Rhizosphere	STATI UNITI	PGP
<i>Komagataella pastoris</i>	PP59	Grape rhizosphere	Ascoli Piceno, IT	PGP
<i>Pantibacillus</i> sp.	R47065	unknown	Ecuador	PGP/IAA production
<i>Paraburkholderia tropica</i>	MDIIIaZo225	Maize rhizosphere	Caserta, IT	Nitrogen fixation
<i>Pseudomonas grandensis</i>	A23/T3c	soil	Lazio, IT	PGP
<i>Pseudomonas fluorescens</i>	DR54	Sugar beet rhizosphere	Holeby, DK	biocontrol
<i>Pseudomonas putida</i>	P1-20/08	soil	Ecuador	PGP
<i>Pseudomonas</i> sp.	PN53	Grass rhizosphere	Ascoli Piceno, IT	PGP
<i>Rahnella aquatilis</i>	BB23/T4d	soil	Lazio, IT	PGP
<i>Raoultella terrigena</i>	FS152	Rhizosphere	South, IT	Phytase activity, siderophore production
<i>Septoglomus constrictum</i>	FL328	Rhizosphere	STATI UNITI	PGP
<i>Streptomyces</i> sp.	SA 51	Rhizosphere	Liguria, IT	biocontrol
<i>Trichoderma gamsii</i>	6085	uncultivated soil	Crimea, UA	biocontrol
<i>Trichoderma harzianum</i>	OmG-08	Orchid roots	Bernburg, DE	P-solubilisation
<i>Trichoderma harzianum</i>	OmG-16		Bernburg, DE	P-solubilisation
<i>Trichoderma harzianum</i>	T6776	soil	Pisa, IT	biocontrol/PGP
<i>Trichoderma harzianum</i>	TH01	Grass soil and rhizosphere	Ascoli Piceno, IT	PGP
<i>Trichoderma harzianum</i>	CBS 354.33/ATCC 48131	soil	USA	chitinase production, biocontrol

In vitro compatibility



Selected microbial consortia

MICROBIAL CONSORTIA (MC)	MICROORGANISMS
A	<i>Trichoderma harzianum</i> TH01
	<i>Pseudomonas granadensis</i> A23/T3c
	<i>Paraburkholderia tropica</i> MDIII Azo225
	<i>Bacillus licheniformis</i> PS141
	<i>Azotobacter chroococcum</i> LS132
	<i>Pichia pastoris</i> PP59
B	<i>Bacillus amyloliquefaciens</i> LMG9814
	<i>Pseudomonas fluorescens</i> DR54
	<i>Bacillus</i> sp. BV 84
	<i>Rahnella aquatilis</i> BB23T3/d
	<i>Azotobacter vinelandii</i> DSM2289

Microbial combinations

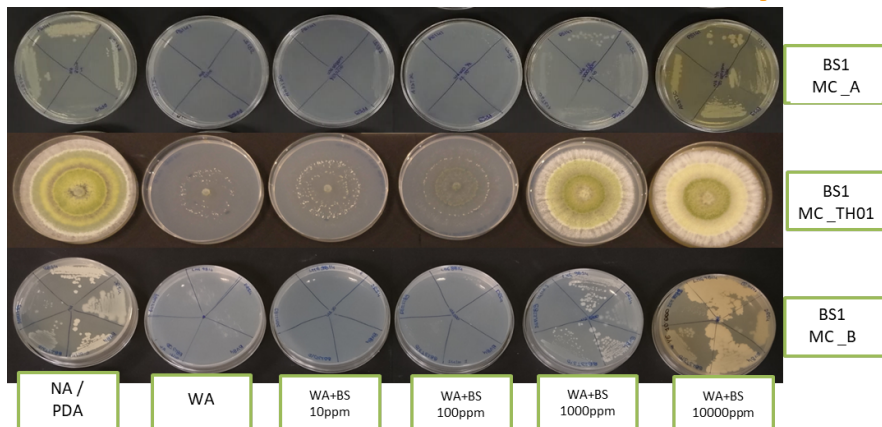
Combination	MC	MC_AMF	BS
C-1	X		
C-2	X	X	
C-3	X		X
C-4	X	X	X

MC: Microbial Consortium (A or B); MC_AMF: consortium of arbuscular mychorrhizal fungi; BS: Biostimulant compounds

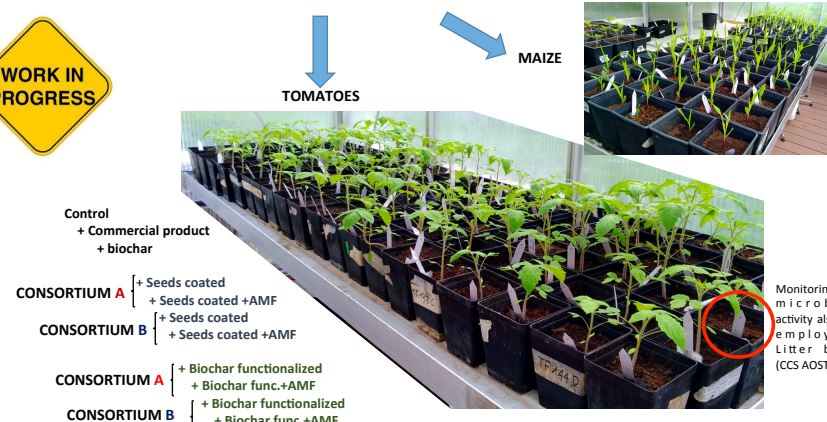
PGP effect



Prebiotic test of biostimulant compounds



Green House Experiments: 2 crops, 2 cultivars, 2 delivery systems, 2 consortia, with and without AMF



Monitoring of microbial activity also by employing litter bags (CCS AOSTA)



SIMBA

SUSTAINABLE INNOVATION OF MICROBIOME
APPLICATIONS IN THE FOOD SYSTEM

Thank you !



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