#### 7<sup>th</sup> Agroscope Conference on Sustainability



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Experiences and challenges in the use of biostimulants and biorational products for a sustainable agriculture

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# Innovak through time

#### Innovak presence across the world





#### Innovak's business model

It's a "customer intimacy model" or "demonstration model" since it requires the grower to be proven the products effectivity so the sale can be finalized. The model is identified with the arrow diagram (value proposition – demonstration - price) in which the demonstration is the core of this model enforced by Innovak's commercial team.



# Reliability of the products: base of our business model

#### Bioproducts development for integrative solutions

- When using microbial-based products, is the inoculant capacity enough to establish and maintain sufficient activity and consistency in the rhizosphere?
- Novel commercial approaches are being developed which aim at amplifying local beneficial microbiota instead of inoculating standardized microbial products [du Jardin (2015). Scientia Horticulturae 196, 3-14].
- A parallel can be made with the human intestinal microbiota: adding inoculants (i.e. 'probiotics') is one thing, but feeding beneficial bacteria with prebiotics seems even more important [du Jardin (2015). Scientia Horticulturae 196, 3-14].



But what happen on rhizospheric microbiota, crops yields and crops quality if "enhancers" of root exudates production (prebiotics) that act as "amplifiers" of the local beneficial microbiota, inoculants (probiotics) and their substances produced (postbiotics) are employed together?

> 16 14

<sup>14</sup>C Activity in root exudates



Complex of phenolic compounds from vegetal sources (SA1)

"ENHANCER"



C = control



Beneficial microbial consortium **(SA2)** 

"PROBIOTIC"



probiotics

"POSTBIOTIC"

- Penicillium billai (P-solubilizing fungus)
- Penicillium rubens (P-solubilizing fungus)
- Trichoderma harzianum (mutualistic fungus strain)
- Bacillus subtilis (PGPR-bacterium)
- Azospirillum brasilense (Auxin production)

How can affect **SA1, SA2** and **SA3** the rhizospheric microbiota, crop yield and crop quality ?





The research is still emerging, but studies suggest that posbiotics play a role in defending against pathogens and helping the immune systems adapt to any changes in the microbiome



Experimental design

Treatment	1	3	5	7	9
Zone 1	Control (soil without plants)	Conventional management	Organic management	Conventional management + SA1	Conventional management + SA1 + SA2
Treatment	2	4	6	8	10

\*Each treatment comprises 4 plots from which 5 plants <u>during flowering</u> were sampled to make a pool per plot for further analyses.

\*\*Conventional management comprises N-P-K fertilization while organic management includes fish hydrolysates and humics.





 Relative abundance of bacteria and fungi at class level



Rhizospheric Microbiome Profiling of Capsicum annuum L. Cultivated in Amended Soils by 16S and Internal Transcribed Spacer 2 rRNA Amplicon Metagenome Sequencing

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Absolute quantitation and mean abundance of fungi and bacteria in the rizosphere/rizoplane from C. anuum. L



[1] soil; [2] rhizosphere conventional crop; [3] rhizoplane conventional crop; [4] rhizosphere conventional crop + SA1; [5] rhizoplane conventional crop + SA1; [6] rhizosphere conventional crop + SA1 + SA2; [7] rhizoplane conventional crop + SA1 + SA2.

\*The values are the average of two independent experiments (4 replicates each one). Bar correspond to the standard deviation

Effect of biostimulants on yields and fruit quality in C. annuum L.



\*The values are the average of two independent experiments (4 replicates each one). Bars correspond to the standard deviation



#### An integrative biostimulant acting as a biocontrol product





Sclerotium cepivorum causes onion and garlic white rot

> An indirect reliable disease control product



An integrative biostimulant



Traditional solutions: direct attack to the causal agents employing nematicides and fungicides

Results: Inconsistent and/or short-time control



- Well root development
- High microbial growth
- High biodiversity, competition and antagonism





development
Poor microbial growth
Low biodiversity, competition and

antagonism

Poor root



However, several times, causal agents proliferation is a symptom of unappropriated culture conditions



#### SOIL COMPACTION (2019)



Treatment with soil conditioners

This procedure is enough for controlling nematodes?

No, but helps to avoid explosive increases of their populations. Besides, productivity is improved.







Integrative biocontrol product:

antagonistic microbial consortium + root exudate production enhancer





Phymatotrichum omnivorum causes Texas root rot

	Year			
Treatment	2015	2016	2017	
Control	0	10*	60*	
CM 2 kg/ha	0	0	0	
CM 4 kg/ha	0	0	0	
CM 6 kg/ha	0	0	0	
CM 8 kg/ha	0	0	0	

\*Number of pecan trees/Ha died by the attack of Phymatotrichum omnivorum



#### Final considerations

- The agricultural sector faces great challenges, such as to guarantee food security for the growing world population, provide safe, GMO-free foods, according market mega-trends, confront global warming consequences, avoid increasing greenhouse gases emission, etc.
- According to these challenges, Innovak's vision for a sustainable agriculture is that "it is necessary to reduce the use of chemicals, using and/or developing complementary ecofriendly technologies and practices, guided by the circular economy principles, that should improve consistently nutrient uptake efficiency, plant fitness and health, fruit quality".

#### Thank you very much for your kind attentioniji

