ISSN 0370-5404
ENTREVISTA

Rev. Ind. y Agríc. de Tucumán
Tomo 95 (1): 57-58; 2018

“The study and understanding of soil microbial populations is really the beginning of a new era”

Conversation with Dr. Charles Rice, specialist in soil health and climate change

"The study and understanding of soil microbial populations is really the beginning of a new era. We have new genetic and molecular tools to detect microbial communities; but it is also necessary to deepen the knowledge of microbial interaction with roots and soil compounds. We are entering an era in which there may be an explosion for research in microbiology and its application. "

This is the opinion of Dr. Charles Rice, leading specialist in issues related to soil health and climate change, who spoke during the XXVI Argentine Congress of Soil Sciences, celebrated in Tucuman in May 2018, whose motto for this edition was "Soils: social legacy, limited edition".

Dr. Rice is a professor at the Department of Agronomy at Kansas State University (USA) and a professor at the Department of Soils at the Federal University of Santa Maria (Brazil). He has a Master's Degree in Soil Science from the University of Kentucky and a Doctorate in Soil Microbiology from the same University.

Rice prefers to speak of "climate change and not global warming, because the increase in temperatures is just one of the factors of climate change that is happening".

In a dialogue with the EEAOC, Rice explains that "today we are looking for farming systems in a more holistic way. We did more reductionist experiments observing individual factors, but when a farmer cultivates a certain species, in reality he is always trying to deal with more complex systems: the crop itself, the climate, the soil, the insects, the diseases. They are elements that make up a complex system. So, we are talking about observing the systems. We ask for example what is the cover crop. Or we see what is the value of fertilizing in a different way. We observe the whole system, instead of thinking only about the crop this year. We think in a more systemic way. Another thing that is a challenge for us, as researchers, is that our funding comes in cycles of three years or five years, and some of these investigations take much longer. If we look, for example, at the influence of carbon on the health of the soil, it will take 10, 20 or 30 years until we can observe important changes. That's why a cycle of three or five years is not good enough; we have to think not only about complex systems but about planning longer-term scientific and financial alternatives".

"On the other hand, today we are able to obtain much more information. They are very rich soil data, even of the daily cycle, that we obtain through the use of sensors. It is a great opportunity. We have to deepen our relationship with computer scientists and computer science, in order to take advantage of this enormous wealth of information for systemic and far-reaching projections. Information that, of course, we have to transform into useful recommendations for the farmer and, at the same time, for the environment”, the specialist says. Rice works on topics such as cycles of nitrogen and carbon in terrestrial ecosystems, ecology of soil microbiology and soil quality.

Rice affirms that "many companies are investing in the discovery of microbes and what they can do for plants. They are great companies. There were always companies that have been questioned because they had "miraculous" products, capable of offering impossible solutions to

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complex problems. But I think we are reaching a point where really serious firms are making very important investments for research and understanding of the interaction between microbes, soil and agriculture. Research that will lead us to a more efficient use of water and nutrients, taking advantage of the relationship between microbes and plants. They are companies that develop drought-tolerant plants, and are finding ways to combine biological control with root improvement and nutrient utilization. This is decidedly a scientifically revolutionary alternative. "

According to Rice, "not always the contest of several disciplines reaches to understand or solve a complex issue. There is a problem of codes that it is necessary to solve. The National Academy of Sciences in the United States planned to publish a report entitled Breakthrough 2030. It is a new agenda for agro-food research and the idea is multidisciplinary. It's about how to incorporate physics, chemistry and biology into the science of agriculture. Part of that challenge-with which I face myself when I try to do research in a multidisciplinary team-is how to overcome language barriers. The dialogue between a computer scientist, a physicist, a chemist and an agronomist is very difficult and sometimes even impossible when it comes to facing the same object of knowledge. It is not the same to think about the soil from the physical point of view to understand the relationship between minerals and water than to think about it according to the physiological needs of a plant's development".

"In the United States we have these major research projects (interdisciplinary and transdisciplinary), in which the participation of social scientists is an unavoidable requirement, which are completely different but essential when it comes to thinking about our interrelationship with the real farmer. Because if we develop a management process for agricultural systems, we need to know how acceptable it will be for the farmer, what are the social or technological barriers, or what is the risk that its application would imply. Some farmers are more concerned about risk than others. There are different levels of "audacity" or conservatism that can not be ignored".

Climate change, knowledge and perspectives

"It is true that climate change occurs from the first moment of creation. The current challenge is that the climate is changing but more quickly than in the past. We need to adapt at a faster pace. For example, it has taken 20 years to create a new plant variety and by the time it reaches the market, the weather will have changed again. We will have to obtain more data and more investment in research. We will have to have a new team of students, from different disciplines, to work together and collect all the information that we need to have. The good news is that today we can do it; we have the skill and technical facilities to do it. We only need more training to analyze the data and make them practically perform, helping to make correct decisions.

The situation is critical, but I am optimistic by nature. We are understanding how the phenomena that affect us work and I hope that we will find not only the theoretical solutions, but the way to apply them as the current conditions require it".

(Dr. Charles Rice).

Soil Health - "The Holy Trinity"

When I think about the health of the soil, I think about what I call the Holy Trinity. It is based on the interrelationship between organic carbon, microbial activity and soil structure. If they ask me to measure only one of the properties -the health of the soils-, I choose carbon, which is directly linked to that microbial activity that is going to build the structure. If we can sustain these three aspects, we will achieve a better infiltration, therefore less erosion. We will conserve much more water, we will allow the best development of the roots and with that we will also be able to be much more efficient in the use of soil nutrients and the conservation of their biodiversity.

Link to Charles Rice conference in the XXVI Argentine Congress of Soil Science
https://www.youtube.com/watch?v=XEJkE_oBTGI *(25:40 – Reference to "Holy Trinity")*