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Editorial

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CS² FARMING: 5 Steps towards Sustainable Smart Farms

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Though often described as an old fashioned economic sector, agriculture is increasingly acknowledged as a crucial catalyzer of the global economy supporting rural development and contributing to poverty mitigation all over the world. Still, if the value of agricultural landscapes is progressively acknowledge their impact is also gradually discussed, especially in a scenario of growing demand, considering both food and non-food crops, such as biofuels. In this regard, careful management of agricultural ecosystems is considered a vital procedure to ensure both environmental health and the sustainability of this sector, particularly when, besides all the argumentative used by farmers, there are no globally accepted sustainable management solutions for agriculture, not only because agricultural practices are directly dependent on site-specific variables, such as biodiversity, climate, soil characteristics, water availability, etc., etc., but also because the agricultural sector faces simultaneously two hard challenges, *i.e*. to assure enough high-quality agricultural production to meet world's population growth forecast and to protect biodiversity and ecosystem services on each and every single agricultural landscape.

Still, even if measuring and analyzing the factors that affect agricultural production at different levels, has long been the subject of several theoretical reflections and numerous empirical and scientific studies, the fact is that there is a growing urgency to enhance the sustainability of existing and emerging agricultural land. Still, summarizing the dynamics and choices involved in this process of sustainable "*smartification*", is especially hard when the sustainability principles inherent to agriculture are generally applied across different management systems, with different configurations.

Still, even if as pointed out by Loures (2017), the need to produce food in an increasingly sustainable manner, not only in terms of crop efficiency, but also in terms of land use and biodiversity conservation in natural ecosystem, highlight the necessity to envision the use of new technologies on different productive systems assessing their impact both in environmental, economic and social aspects (Ponisio and Ehrlich, 2016; and Pywell., *et al*. 2015), the fact is that, even if several agricultural management systems had been envisioned during the last decades (precision agriculture, hi-tech-agriculture, organic farming, conservation agriculture, sustainable agriculture, smart farming), "recent events" had made clear that we need to move towards a much more integrated concept of agriculture, directly based on site specificity in which all the issues and principles mentioned before are part of the same equation.

Getting this equation right is a challenge that all farmers need to face, if they actually believe in the future of the agricultural sector. CS²F - Climate Smart Sustainable Farming - is not a utopia, but rather a simple agricultural management process that aims at bringing together a set of practices and technologies that increase productivity, and build farmers' resilience to climate change, while decreasing inputs and maximizing yields.

CS^{2}F is not a matter of changing current agricultural practices but rather an opportunity to reinvent and rearrange them both in ecologic, economic and social terms, enabling agricultural land to totally fulfill its potential. In this regard, there are 5 steps that are considered the basis of this process, namely:

1. To be climate resilient - it is a fact that climate change is increasing the severity and frequency of extreme weather events; still, adequate crop selection reduces the risk of loosing productivity. Investments in climate-smart technology, which enables farmers to predict weather variability makes it easier for farmers to control their crop management activities, to select varieties to plant and when to plant them, granting that climate information and advice is directly in farmer's hands, helping them make informed decisions on their farms (CCAFS, 2015).
2. To promote water saving and storage - as mentioned by Loures., *et al*. (2017) water is a scarce commodity essential to life that must therefore be preserved and respected. However, the problem of water use in agriculture is not only related to the fact that irrigated agriculture is responsible for the use of 60 to 80% of all available water, but above all to the low efficiency of the vast majority of irrigated systems, with the latest estimates pointing out that more than 60% of water diverted to irrigation is wasted, not only due to the incorrect management of irrigation (excess water); the use of inadequate irrigation techniques (such as flooding); the lack of maintenance, monitoring and inspection of irrigation systems; but mainly due to inappropriate crop selection, considering the climate conditions of the region (Nunes., *et al*. 2017). In this regard, considering the high percentage of water consumed by agricultural practices, the problem is both associated to high consumption coupled with low storage capacity, since recent data indicate that only a small percentage of the available water for irrigation is used. The proposal of S^2 agriculture considers the implementation of these symbiotic approaches as a crucial step to increase the sustainability of agricultural practices.
3. To increase biodiversity and ecosystem services - regarding biodiversity and ecosystem services as mentioned by Swinton., *et al.* (2007) it is important to agriculture to both provide and receive ecosystem services that extend well beyond the provision of food, fiber, and fuel. In fact, one of the crucial steps to achieve S^2 agriculture is to understand how ecological functions generate ES in agricultural landscapes, not only to enable the re-adaptation of management systems to forms which permit the design of cost-effective incentives to provide ES and to measure which kinds of ES could provide the greatest overall welfare benefits not only at the productive level, but also regarding environmental and societal benefits.
4. To promote soil sustainability - soil is a scarce resource which is ultimately the "system" which absorbs que consequences of continued agricultural practice. In this sense, soil degradation, associated in part with the cultural intensification is a factor that cannot be ignored when assessing agricultural management systems and their predictable impacts. As argued in several studies, cultural intensification has significant impacts on soil, such as the decrease in organic matter content, as well as the thickness of the soil itself (Loures., *et al*. 2017; Nunes., *et al*. 2017), since the greater the cultural intensity, the greater the need for soil mobilization and the greater the destruction of its organic matter (Nunes., et al. 2017). In this sense, in order to achieve S^2 farms, irrespective of the principles and/or practices that may be applied to the agricultural management system, it is crucial to understand soil as a limited and scarce resource which needs to be protected, avoiding all the predatory agricultural practices, and reinforcing the application of conservation agriculture practices that promote soil sustainability.
5. To add value to sustainable agricultural practices – though it is crucial to address technical and financial constraints inherent to agriculture, public perception and support is essential for scaling-up. One way to reinforce promotion for CS^2 agriculture is by producing and consolidating evidence of its benefits, in opposition to the negative externalities of other agricultural systems generally associate to high-input processes as is the case of intensive monocultures. Only by scaling up it is possible to help independent small and medium scale farms and farmers to compete in a fair market, so that they can increase production while safeguarding the common environment. The implementation of successful CS^{2}F will, in this regard, contribute to support vibrant rural communities, promoting local and regional development crucial to inspire rural communities that enable not only to increase, agricultural sustainability, but also food security and environmental protection.

In summary, though it is a fact that recent research has evidenced ways to achieve high yields while mitigating environmental impacts associated to conventional farming (Foley, 2014), we believe that the application of CS^2 farming processes, considering the five aforementioned principles in association with several other innovative ways to reduce the use of water and the application of fertilizers and pesticides through the implementation and use of computerized systems, advanced sensors, GPS, etc. etc. would be the wisest solution, exploring all of the good ideas, whether from organic, high-tech and/or conventional farms, and getting a system which blends the best of both.

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