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Conceptual paper

Potential of science to address the hunger issue: Ecology, biotechnology, cattle breeding and the large pantry of the sea

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ABSTRACT

The knowledge about the real possibilities that current science gives us is basic to support everything that is not negative either for men or for our environment. In this way, it is an advantage to win this battle against hunger with rational use of science advantages. In this paper, we start from the basis that the solution to the problems of hunger requires the multidisciplinary action of sciences and knowledge. We provide a reflection on the possibilities to be considered from disciplines such as ecology, biotechnology, veterinary and aquaculture. The need for ecological studies where the role of human beings as part of ecosystems is considered. In addition, advances in molecular biology and precision agriculture are analyzed, evaluating their advantages and associated problems, as well as understanding the role of veterinary science and animal genetic improvement in the problem of hunger. Finally, the bases the sustainable use of sea products and expectations generated by marine crops are presented.

Hunger is without a doubt one of the most dire problems humanity is facing in our times. Many, such as myself, fortunate enough to live in developed countries, tend to consider it as someone else's problem, for whom we should feel sorry and provide some form of support. There is always some campaign to collect food or an NGO that helps us keep our consciences at ease. There is nonetheless something that we can do amongst us all and that would undoubtedly contribute to mitigate the problem, and it is merely knowing the actual possibilities that modern day science offers us and support anything that, without being negative to man or our surroundings, provides us with an advantage in our fight against hunger. That is why it is so important that people that are involved in science be capable of basing their research and findings on proper anthropological grounds, on a philosophical basis that would give meaning to their science. In the case of believers, the Christian worldview offers an exceptional contribution by providing a solid base whereupon the beliefs in terms of such problem may be built.

The challenge that is implied by vanquishing hunger must be addressed from a multidisciplinary perspective covering various sciences and knowledge. Scientific ecology is an experimental science that may contribute a great deal of transcendental information for decision making, on many of the aspects regarding the problems of hunger we face at present. There is excellent scientific literature speaking to the challenges of ecology in our days, from pure research to responses applied in relation to environmental restoration and management, and government policies, in addition to focusing on protected areas, post-industrial landscapes and the urban environment (Sutherland et al., 2013), which aspects must undoubtedly be very present among our objectives. Hunger and the search for solutions nonetheless would not seem to be determinately reflected or be the focus of concern of ecology. Unfortunately, the system for valuing research is not of much help either. A scientist knows that for their research to be recognized or valued, it must be published in certain scientific journals. Would it not be more beneficial to publish the advances that our research could contribute to mitigating hunger around the world in farming, cattle breeding, fishing or other such magazines? We must nonetheless find ways for society to know of the advances and their pros and cons so that those that are not involved in science may be made

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aware, based on strong criteria and not on fundamentalism, the reason for implementing a certain technology, farming system or new food. It is obvious that the latter, the popularizing of science, is sought, but it would seem that in this case the result is not successful. Society and, therefore, politicians are who make the ultimate decisions, and these would not seem to revolve around a common solution, and this seriously hinders decision making. It is necessary, as Francisco (2015) has noted, that the urgent challenge of protecting our common house include the concern for unifying the entire family that is humanity in the search for sustainable and comprehensive development for things to change. We must be aware, as noted by Zardoya (2012) in the case of the biodiversity crisis, that mankind has an enormous capacity to alter the balance of nature and it is necessary to accomplish that the international scientific community act in coordination. At this point, it is interesting to add that these postulates should work for ecology to also focus on the problem of hunger from a positive perspective, setting aside the catastrophic vision of human activity in all that pertaining to ecosystems.

The bibliography provides various definitions of scientific ecology, where one that is current and that clarifies it quite well is provided by the Ecological Society of America: "scientific discipline that is concerned with the relationships between organisms and their past, present, and future environments. These relationships include physiological responses of individuals, structure and dynamics of populations, interactions among species, organization of biological communities, and processing of energy and matter in ecosystems". If we were to focus on the last part of this definition, we would see that this science speaks of the resources, matter and energy that nature provides living beings, i.e., the potential food that each species could have at their disposal within an ecosystem. Undoubtedly, human beings form part of the ecosystems and have the same rights as any other organism to be able to use the available matter and energy, yet this must be done responsibly and with respect toward the rest of nature. As said by Francisco (2015), it is the duty of mankind, having been endowed with intelligence, to respect the laws of nature and the delicate balance between the beings of this world.

Our planet makes available to the living beings of our biosphere, including humans, the matter and energy for its development as a whole. This energy is used by part of the living beings as food to stay alive. In this sense, human beings need the resources of nature for nourishment. Considering our intelligence and ability to transform our environment, it is our responsibility to maintain a sustainable balance with nature.

If it is positive that there be a global balance of food available to mankind, i.e., that there be more than enough food on the planet for all mankind to survive, what is going on? The problem is that these resources are not being appropriately managed. We must therefore put all sciences, such as ecology, at the service of the common good, without casting aside the possibilities that sciences such as biotechnology offer to the problem of hunger in the form of precision agriculture, advances in metabolomics and functional food, while also considering the potential of ecological agriculture, aquaculture, improvement in cattle production, changes in eating habits, etc. There are many scientists contributing extremely interesting knowledge to improve the quality of food, such as based on metabolomics studies, for instance (Johanningsmeier, Harris, & Klevorn, 2016) suggesting that 32.5% of the metabolites identified to date are incorporated in the diet and are over-conditioned in the human metabolism, which means that, learning their origin and being able to channel them appropriately would contribute to overcoming the problem. Other interesting keys are stressed by the FAO (http://www.fao.org/docrep/006/w0073s/w0073s0x.htm; americas/noticias/ver/es/c/229495/) in relation to the water footprint implied by the production of various types of food. A change in eating habits considering the above could also help. Or precision agriculture based on genetically modified organisms, which although should not be considered universal and unique universal solutions, may be key in some places of our planet.

Obviously, if we look at the Earth as our great ecosystem, this planet has room for us all. It just needs to be properly managed.

Evolution of transgenic food. Current analysis of the subject

Transgenic or genetically-modified foods have allowed the increase in the availability of nutrients to the population and the improvement of the useful and shelf life of food. Such food is therefore proposed as a tool to solve the world hunger issue. It has been observed that in populations where there has been an increase in food production, in part due to the introduction of transgenic food, there has been a considerable reduction in the percentage of poverty in the region (Ravallion & Datt, 1996; Thirtle, Lin, & Piesse, 2003).

Biotechnology is a multidisciplinary science based on the knowledge and use of the biological processes of living beings which, applied to food, seeks to increase production and attend to the demands of the consumers for safer and healthier products. Food of a vegetable origin is one of the main sources of nutrients for a great part of the world population (Silva & Ortiz, 2011) but cannot guarantee the needs for micronutrients of the population and does not resolve malnutrition in certain sectors thereof. Agricultural production implies the development of better biotechnological tools, satisfying not only the increasing demand for food, but also guaranteeing nutritional quality and thus mitigating malnutrition in certain regions around the world (Pingali, 2012).

The relationship existing between diet and health by the influence exerted by nutrients on physiological processes is a proven fact (Mutch, Wahli, & Williamson, 2005). Nonetheless, for a large part of the world population, vegetable foods are used merely to provide essential nutrients and without guaranteeing a supply of micronutrients that would allow for the prevention and treatment of diseases (Newell-McGloughlin, 2008).

According to the World Health Organization, biofortification is the process whereby the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding or modern biotechnology. The biofortification of the basic foods eaten by the majority of the population is an effective strategy for correcting the deficiencies of micronutrients where there is a need to supplement basic food with micronutrients.

From a biotechnological viewpoint, we could consider plants as versatile biochemical factories, capable of synthesizing micronutrients. Genetic modification allows for transferring specific features, such as the capacity to synthesize vitamins, for instance, to food that does not produce them in nature. It also allows for enhanced control of the production of crops and it is possible to express the chosen features in less time than through the use of conventional crops. Golden rice (Ye et al., 2000) is one of the first examples of biofortification, but it is not the only one. There are currently a large number of research projects to enrich the nutrient content of regularly-consumed plants, to improve health and prevent the appearance of diseases among the population. Zinc deficiency is a true problem for health among children, as it causes stunted growth. *Brassica oleracea*, has been biofortified to produce a greater amount of such trace element, guaranteeing the availability of an adequate source of Zinc (Barrameda-Medina et al., 2017). The same occurs with the obtaining of biofortification in folic acid, a key molecule for proper embryonic development (Strobbe & Van Der Straeten, 2017) or with selenium biofortification (Garousi, Kovács, Domokos-Szabolcsy, & Veres, 2017) and other micronutrients such as vitamins, essential amino acids, essential fatty acids, etc. (Hirschi, 2009).

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