

Self-Management of Biosecurity in The Agroecological Transition Towards Sustainable Food

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Abstract

Biosafety is addressed from different socioeconomic sectors. The agroecological transition towards sustainable food requires holistic self-management of biosecurity, considering primary and post-production of food, complementary services and the population's attitude towards food. Agroecological self-regulation and participatory self-management of biosecurity are recommended.

Key words: biologists; biodiversity; biotechnologies; microorganisms

Introduction

Health is a continuum from the earth to our bodies, dictated by the interconnection and interrelationship between humans, nature's biodiversity and its systems, determined by the connecting pathways between soil health, plant health, the health of animals and, therefore, human health (Shroff and Cortés, 2020).

The increase in the diversity and volume of international trade in animals, plants and their products contribute decisively to the spread of diseases from one region to another. Changes in farming practices are creating new health hazards that easily cross borders. Variations in human ecology and behavior also contribute to the increased incidence and spread of important hazards to public, animal and plant health. New biotechnologies add another dimension: for example, it is necessary to evaluate any possible health risks in organisms and products obtained by biotechnological means (FAO, 2007).

The conservation of biodiversity and the generation of ecosystem services constitute strategies that are promoted and executed by the institutions that manage ecosystems, which is also being assumed by the governance of socioeconomic systems; however, it is evident that a more integrated vision is required at the scale of agricultural and urban landscapes, due to the pressure that development exerts on anthropogenic self-extinction (Vazquez, 2024a).

By recognizing that human, animal, and ecosystem health is inextricably linked, One Health seeks to promote and improve health by enhancing cooperation and collaboration between physicians, veterinarians, agronomists, biologists, and other professionals (Zinsstag et al., 2010). The many dimensions of agro-ecology need to be integrated into a holistic approach that takes into account the inter-relationship between humans, animals, and the Earth (VSF, 2014).

In this regard, biosafety is a strategic and integrated approach that encompasses policy and regulatory frameworks (including instruments and activities) for the analysis and management of risks relating to the life and health of people, animals and plants, and the associated risks to the environment. It covers food safety, zoonoses, the introduction of animal and plant pests and diseases, the introduction and release of living modified organisms (LMOs) and their products, and the introduction and management of invasive alien species (FAO, 2007).

Biosafety is conventionally addressed from the different socioeconomic sectors, where rigorous management systems are established; however, the need to act synergistically in the face of health risks for agricultural production, people and the environment is evident. Precisely, the objective of this article is to draw attention to the self-management of biosecurity in the agroecological transition towards the construction of sustainable food systems.

Agroecological self-regulation. Agroecology emerges as a discipline that provides basic ecological principles on how to study, design and manage agroecosystems that are productive and at the same time conservative of natural resources and that, in addition, are culturally sensitive and socioeconomically viable (Altieri, 2010), whose complexity and multifunctionality, in addition to contributing to the ecological self-regulation of harmful organisms, soil fertility and microclimate, among other ecosystem services, it reduces the multiplication and dispersion of organisms harmful to crops and livestock, due to various ecological functions that are facilitated (Altieri and Nicholls, 2007).

The interrelationships between multiple species of plants and animals, along with natural processes, provide clean air and water, rejuvenate soil fertility, create niches for multiple species, and provide a wide variety of food and genetic resources, functions that make ecosystems healthy are resilient to

sudden climate changes, natural disasters or disease outbreaks; processes that have a direct and tangible link with human health, since there is an intimate connection between soil biodiversity, microorganisms, plants and their seeds, wild and crop varieties and species, animals and the biodiversity of our diet and intestine (Shroff and Cortés, 2020).

In the search for a healthy diet, the redesign of food production systems under the principles of Agroecology, facilitates the functional interactions of biodiversity that contribute to its capacity for ecological self-regulation and that of the intestinal ecosystem of the people who consume said foods (Vázquez, 2022).

The intestinal ecosystem is a complex environment in which dynamic and reciprocal interactions occur between the epithelium, the immune system and the local microbiota (Almada et al 2015). Likewise, the concept of a nutrient as any assimilable substance contained in food, which allows the body to obtain energy, build and repair tissues and regulate metabolic processes, has passed to that of an immunonutrient, which is a substance that, unlike a nutrient conventional, is capable of enhancing the immune system (Chandra, 1991).

The effects of agroecological transformation are cumulative over time. For agroecological self-regulation capacities to be expressed in systems, the implementation of a coherent and systematic process is required regarding the reduction of degrading practices (agrochemicals, excess mechanization, single cultivation, bare soil, others) and the progressive integration of agroecological practices (designs and management), so that the selection pressure of resistant populations of the biota associated with negative functions (harmful organisms) is reduced and the biota associated with positive functions is regenerated (decomposers of organic matter, pollinators, natural enemies of harmful organisms, rhizospheric and epiphytic microbiota, plant, animal and human microbiome) (Vázquez, 2024b)

Self-management as an attribute of sustainability also contributes to the agroecological self-regulation capacity of the food system, through the integration of various types of agricultural and livestock production systems, which in turn diversify production and facilitate food self-sufficiency; the decentralization of biotechnologies is promoted for the self-management of bioproducts, reproductive material and food processing and short marketing circuits and changes in the population's attitude towards food and health emerge.

These new characteristics in the functional redesign of the territory, although they reduce the risks of introduction and establishment of harmful species to non-existent in plants, animals and people, put pressure on the capacity of health surveillance and biosafety control entities, due to a greater diversity and dispersion of service and production units, with high prominence of the resident population.

Biosafety self-management. The food system can be defined as the set of socioeconomic relationships that directly affect the production and distribution processes of agri-food products, to satisfactorily fulfill the social function of food-nutrition with safe or safe foods (Malassis, 1979).

In the food system, microbiological agents that cause pathologies in people, animals and plants can be disseminated through different routes, such as: (a) interactions with sick individuals, (b) reproductive material (plant, animal), (c) food (animals and people), (d) manipulation by people (cultivation, breeding, harvesting, slaughter, benefit, processing, transfer), (e) vectors (insects, arachnids, nematodes, others), (f) air currents, (g) soil and rainwater flows, (h) water used for drinking (animals and people) and watering (crops), among other ways that are specific for different groups of organisms. This complexity in dissemination positions biosafety as a universal responsibility, whose measures should not be limited to the entities that manage the different processes, but should also be popularized, as a social and personal attitude.

Regarding the acquisition and consumption of fresh agricultural products, five characteristics predominate in the personal and social behavior of the majority of the population: supply, quantity, size, appearance and access; although, there are sectors of the population and places where they also consider that they are free of chemical substances and have nutritional value, attributes that have been promoted by organic agriculture, agricultural production model has also contributed to the perception of the safety of raw materials and additives used in processed products. Recently, based on the experience of the pandemic caused by Covid-19, the population also considers the biosecurity of livestock products, whether live animals or their products (Vázquez, 2024c).

In fact, biosecurity is a complex problem that changes on the basis of multifaceted processes, such as interactions between humans, microorganisms, anthropic and ecological environmental factors and, on the other hand, between political and socioeconomic tensions (FAO 2010, Wilson, 2008). Therefore, the organization of said security through the application of basic principles (practices and procedures, security equipment and facility design) is an unavoidable task in each entity where biological agents are manipulated (whether for teaching, research or in the biotechnology industry), which may affect man, the community and the environment (Cobos, 2021).

Considering the complexity in the manifestation and dissemination of the causal agents of health problems, which can become epidemics and pandemics, whether in crops, livestock or people, with possible human-animal interactions, the need to move towards a biosafety self-management that is holistic, synergistic and participatory, at the scale of territories and communities.

Primary and post-production of food, and complementary services, are basic processes carried out by various units in rural, peri-urban and urban areas of the territory, which during the agroecological transition are articulated through value chains to consolidate the self-management capacities of the food system; in turn, feeding by the population, which is also considered a process, although it is influenced by access to food and education on health determinants, is a cultural attitude of people and their families towards the ingestion of food (Figure 1).

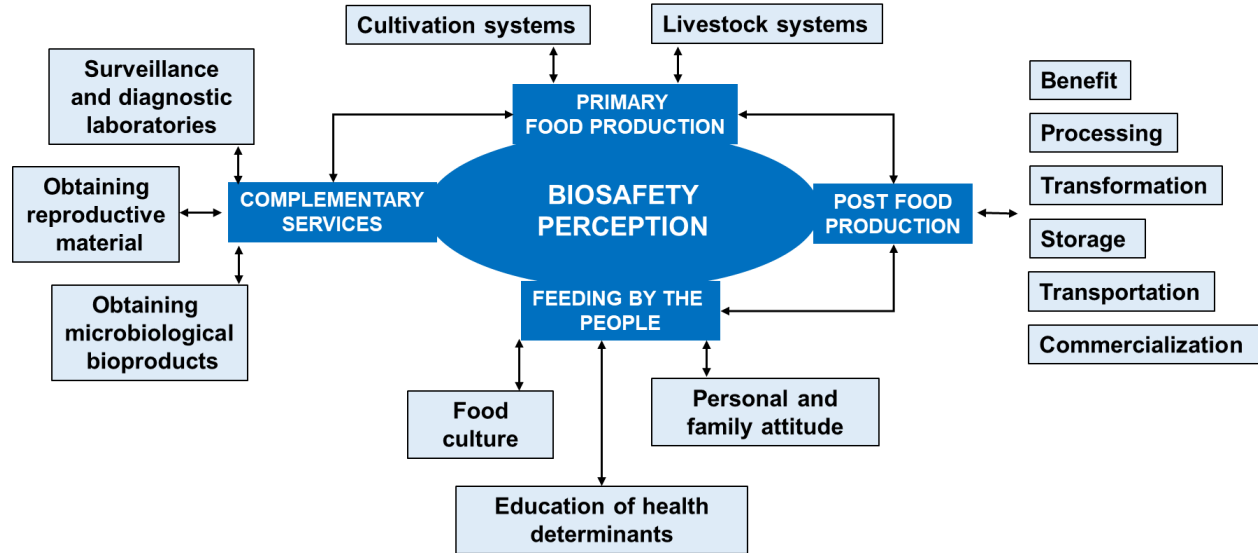


Figure 1: Socioeconomic processes in biosecurity self-management during the agroecological transition.

The health risks that can directly affect the people who work in the units where these socioeconomic processes are carried out and the rest of the population of the territory, justify the need to strengthen the perception of biosafety during the agroecological transition towards sustainable food.

Biosafety implies having a culture in biological safety, the perception of biological risk, biosafety procedures adjusted to each entity, bioprotection, risk analysis and the causes of biological risk occurrence (Nissi et al 2015, Carvalho et al 2013). That is, it is a system that integrates knowledge, organizational processes, cultural values and representations, as well as technical elements (Cobos, 2021).

Biosafety is increasingly applied in different scenarios, which demonstrates its importance today; however, there are deficiencies in its management due to ignorance and low perception of risk, which is why work must be done on the basis of to promote a culture of biological safety as a driving force for the implementation of biosafety adjusted to each of the scenarios where it must be applied (Cobos, 2021).

Conclusions

The self-management of health risks in the food system is a transdisciplinary co-construction, which implies synergistic action in: the transformation of systems for the agroecological self-regulation of organisms harmful to people, animals and plants; the surveillance and action system against health risks; and the population's perception of biological safety.

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