

Research Priorities and the Future of Alfalfa in Latin America

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Abstract: Agro-food and agro-industrial systems in Latin America must anticipate future trends and ensure permanent adjustment of research priorities to the evolving global needs. Innovations should follow the logic of productive chains, which are highly dependent upon knowledge and technology. Agribusiness sector needs to reinvent itself for efficiently providing new products based on stricter quality controls, traceability, and greater diversification. In the region, alfalfa has an enormous potential to be cultivated for multiple purposes other than just animal products, going from pharmaceutical and cosmetic industry to human consumption. No single organization or isolated group of scientists hold alone the capacity to deal with increasingly complex and dynamic production systems in order to efficiently compete in a globalized market. These challenges require an interdisciplinary approach, not only to a domestic level but also to an international one. The present paper proposed the constitution of a virtual alfalfa network platform for articulating and guiding alfalfa research efforts in Latin America. The network will focus on identifying the most important needs for Latin America, promoting an active interaction among educational and scientific institutions through collaborative research projects. The platform comprises four main research axes: (1) efficient production (agronomy); (2) animal production (diversified feeds); (3) quality and innocuousness applied (human feeding); (4) novel products (pharmaceutical and cosmetics). During the initial phase, the Brazilian Agricultural Research Corporation (EMBRAPA, Brazil) and National Institute of Agricultural Technology (INTA, Argentina) will jointly coordinate the network.

Key words: Alfalfa, research priorities, Latin America, technological innovation, international cooperation.

1. Introduction

South America is an important provider of agricultural products for the world [1]. However, most of these products are commodities with little or no added value. Therefore, as a whole, Latin America must develop efficient agro-food and agro-industrial systems able to meet global requirements. In doing so, it is crucial to anticipate future trends and ensure permanent adjustment of research priorities to the evolving needs. Innovations should follow the logic of productive chains, which are highly dependent upon knowledge and technology [2]. The final goal is to provide adequate quantity and quality of food and

industrial products to a constantly increasing demand while preserving natural resources and adding value to the final production. To achieve that, it is necessary to invest in research with multidisciplinary approaches able to generate convergent technologies that allow the development of increasingly complex production processes. It is widely accepted that no organization or isolated group of scientists hold alone the capacity to deal with increasingly complex and dynamic production systems in order to efficiently compete in a globalized market. In this context, identifying a crop that may act as a leading case for promoting such an international cooperation in Latin America could act as a corner stone for this articulated development. alfalfa (*Medicago sativa* L.) is a suitable candidate for this approach, since it is grown in most of the region

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and it can be used for both agricultural and industrial purposes. The objective of this paper was to propose the formation of an international research alfalfa platform integrating activities among Latin American countries. Through this platform, the goal was to articulate research activities in order to avoid overlaps, therefore using much more efficiently the available human, economic, technical and industrial resources.

2. Alfalfa in Latin America

The present migration from production systems with few activities to others with multiple and diverse components will be much stronger in the coming decades. In this context, the growing need for dynamic and innovative processes will be a significant part of the agribusiness horizon that opens up for the future. This scenario will require new agricultural, sociological and environmental paradigms and will place Latin America on the spotlight. Not only the advance of urbanization but also the new and more sophisticated dietary habits of the population are pushing for a higher and innovative demand of goods and services. In turns, the latter exerts even more pressure for the efficient and sustainable use of natural resources. As a result of these changes, the agribusiness sector needs to reinvent itself for efficiently providing new products based on stricter quality controls, traceability, and greater diversification.

Potential for this improvement exists. According to the UN [3], the world population will reach 9.8 billion inhabitants by 2050, and this will require the production of 70% more food. The number of inhabitants of Latin America and the Caribbean will grow by 25%, going from 635 million to 793 million in 2061, according to the Economic Commission for Latin America and the Caribbean [4]. On the other hand, Latin America holds about one third of the world's freshwater resources and more than a quarter of the world's arable land. Its agricultural production has an enormous variation, ranging from subsistence

to sophisticated agribusiness, and represents 16% of the world exports [5]. Today, about 50% of the region's food production comes from its 14 million small farmers. While for many these figures may be relatively unimportant, for entrepreneurs they represent a very interesting market (i.e., land areas) to be conquered.

To take full advantage of the opportunities previously described, Latin America must move forward to support the expansion of the agro-food and agro-industrial systems. As an example of one type of actions that need to be done, this paper proposed the creation of an alfalfa platform focused on organizing and articulating alfalfa research amongst Latin American countries. The goal was to generate the required knowledge and technologies that promote innovations and sustainable development in the region.

Why alfalfa? In Latin America there are about four million hectares cultivated with alfalfa, most notably in Argentina, with nearly 3.2 million hectares, followed by Chile (120,000 ha), Peru (120,000 ha) and Uruguay (70,000 ha). In Brazil, there are at present just about 35,000 ha, mostly located in the southern region; however, there is an enormous potential for expanding the crop towards the Savanao and Caatinga biomes.

In addition, alfalfa is a multifaceted plant that presents an unparalleled potential for multiple purposes other than just animal products, going from pharmaceutical and cosmetic industry to human consumption. Regarding animal feeding, it stands out for its unequalled forage quality characteristics either as exclusive or complementary (supplement) feed for cattle, goats, equines, sheep, swine, poultry and small animals (pets).

In Argentina, where alfalfa has been used for over 150 years, direct grazing and cutting for hay are the most important practices for alfalfa production [6-8]. While in Peru, Chile and Brazil cutting for hay is by far the predominant way of alfalfa use, grazing is the

most important one in Uruguay. As a difference from the other named Latin American countries, tropical conditions in Brazil impose specific management practices for the crop. Nonetheless, the country published relatively few research articles regarding alfalfa. The first cultivar evaluations were conducted by the Brazilian Agricultural Research Corporation (EMBRAPA) in the 1990s [9] and later the economic advantages of utilizing alfalfa for milk production were stated by several authors [10, 11].

Considering the increasing and yet unsatisfied regional and global demand for hay, production of high-quality alfalfa hay is promising throughout Latin America. Improving forage quality using conventional and molecular tools is a recurrent breeding objective that has been prioritized. The application of molecular markers assisted selection and transgenesis widens the possibilities for alfalfa improvement [12-14]. Crop management and hay machinery are also important topics that must be included in the research agendas.

In the cosmetics industry, alfalfa extract is an

important part of creams for facial rejuvenation and hair treatment [15]. Regarding pharmaceutical industry, alfalfa extract has hepatoprotective and estrogenic activities, as well as a known effect in treating stomach disorders [16]. In modern cuisine, alfalfa sprouts are excellent functional and healthy food with multiple benefits [17]. Possibilities for expanding these new alfalfa uses are certainly very promising.

As mentioned before, facing this challenge requires an interdisciplinary approach, not only to a domestic level but also to an international one. In this context, the conformation of technological platforms, acting as an inductor in the generation of knowledge, will greatly contribute to the accomplishment of such a transformation. These platforms, enabling the formation of clusters of researchers and institutions, will generate a significant progress in searching for competitiveness and technological modernization. This will enrich not only the capabilities of every country, but also of the region as a whole.

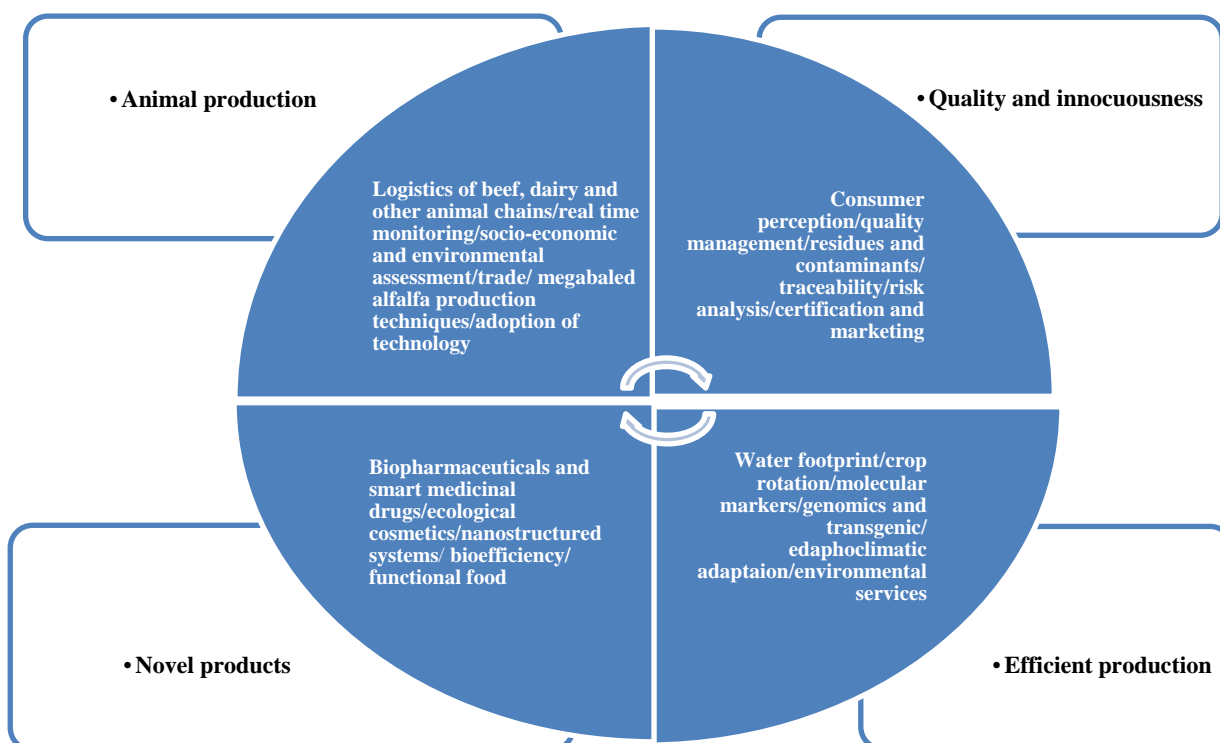


Fig. 1 Organizational chart proposed for the Latin American Alfalfa Research and Development Platform composed by four main structural axes: efficient production; novel products; quality and innocuousness; animal production. A preliminary list of topics to be addressed is included in each ax.

The present paper proposed the constitution of a virtual alfalfa network platform for articulating and guiding alfalfa research efforts in Latin America. The network will focus on identifying the most important needs for Latin America, promoting an active interaction among educational and scientific institutions through collaborative research projects. In doing so, the information generated by the network will be shared by all the participating countries in order to efficiently use the available resources. Fig. 1 depicts the organizational chart for this network, divided into four axes: (1) efficient production, connected to the agronomic aspects of the crop; (2) animal production, including different forms of use; (3) quality and innocuousness applied to human feeding; (4) novel products, involving the pharmaceutical and cosmetic industries. All axes aim to add value to the productive alfalfa chain via the application of adapted or generated technological and managerial innovations.

The exchange of information among potential users of this network will create cumulative expertise that will be of fundamental importance for future alfalfa research, avoiding duplication of actions and simultaneously serving as a database available for the productive and industrial sectors.

Fig. 1 also includes a preliminary list of topics to work on. Nonetheless, and based on the distinct conditions and information gaps from the different countries, research priorities will be defined in accordance to the degree of relevance for each one. For instance, important topics for Brazil—with distinctive soil characteristics and tropical/subtropical climate—may differ from those countries like Argentina, Uruguay and Chile, not only with other environmental conditions but also with more advanced stage of knowledge concerning alfalfa.

During the initial phase, the network will be coordinated by EMBRAPA, for those topics dealing with research under tropical and subtropical

conditions, and by the Argentine National Institute of Agricultural Technology (INTA), for research under temperate conditions.

3. Conclusions

Diversification of alfalfa use has a significant potential for Latin America. Utilization of alfalfa not only for animal feeding but also for pharmaceutical, cosmetic, human consumption and pet feeding offers an enormous opportunity for regional development. In doing so, conforming an international platform for organizing research activities will certainly help to be more efficient in using resources as well as to increase the potential for making a significant and harmonic impact in the region.

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