Chapter 10

Progress and future challenges

Julio Cesar Pascale Palhares
Rachel Bardy Prado

Introduction

Brazilian agricultural research faces many challenges to promote sustainable development, among which are systematizing all knowledge created, standardizing and integrating methods, transforming knowledge into solutions to be directly used by society, gathering enough financial resources, bringing scientists and decision makers closer together, among others.

Based on its research results, the mission of Embrapa is to contribute to the development of agriculture while ensuring the sustainability of rural environments.

The program Embrapa Agropensa surveyed megatrends for Brazilian agriculture. Among these, those related to the targets of Sustainable Development Goal 12 (SDG 12) are shown in Table 1.

Knowledge creation regarding sustainable consumption and production

Due to its widespread geographical reach, Embrapa has Units focused specifically on the problems of large Brazilian ecoregions or natural resources such as Embrapa Eastern and Western Amazon, Embrapa Coastal Tablelands, Embrapa Cerrados, Embrapa Pantanal, Embrapa Soils, Embrapa Forestry, Embrapa Environment, Embrapa Mid-North, Embrapa Temperate Agriculture, etc. Because Embrapa project portfolio is organized according to relevant theme networks, the Company has been operating and contributing to address several issues related to SDG12.

Some networks are worth mentioning, named Portfolio and Arrangements by Embrapa, such as:

Portfolios – Climate change, biological control, coexistence with drought, integrated crop-livestock-forest system, rational pesticide management, land use and coverage dynamics monitoring, native forest resources, ecologically based production systems.

Table 1. Megatrends for Brazilian agriculture and its connections to SDG 12 targets.

Target	Megatrend
12.2	Expanding the use of integrated and sustainable agricultural production systems, aiming at reducing environmental and economic risks and increasing productivity and profitability.
	Carrying out studies and performing agricultural practices that lead to increased efficiency of input use in agricultural systems.
	Devising indicators and socio-environmental certification protocols for farms and rural products, seeking to increase process efficiency and reduce environmental impacts.
	Developing alternative nutrient sources and expanding the use of biological nitrogen fixation (BNF) to a larger number of plant species.
	Developing technologies and protocols to recover degraded agricultural areas for production or conservation purposes, and encouraging the creation of tools to support the implementation of incentive programs to encourage restoration of degraded areas.
12.3	Developing technologies for easy handling and convenience as features of food, as demanded by the growing urban population.
	Ensuring a systemic perspective while developing new technologies, so that all links of productive chains are covered and final consumer and their demands and preferences are met.
	Developing technologies to reduce agricultural product post-harvest losses.
	Supporting public policies and programs to reduce food loss and waste (FLW).
12.4	Developing technologies and systematically arranging knowledge that contribute to generating data and information on soil and water resource use and conservation.
12.5	Developing value-adding technologies for co-products, wastes, and effluents from different chains.
	Optimizing the use of agricultural waste and developing new processes for the management and use of animal production waste.
	Encouraging the development of new initiatives and processes to help reduce product and input losses in agricultural production chains.
12.8	Developing more integrated processes for the use of open standards that allow data communication and information in all domains (rural/rural – rural/urban).
	Expanding the adoption of strategies to develop Crowd Science or citizen science, to appreciate and incorporate external knowledge about processes and phenomena analyzed and/or to validate results and products from research projects.
	Creating and systematically arranging knowledge and tools to support the implementation of programs to disseminate good agricultural practices.
	Supporting the restructuring of Technical Assistance and Rural Extension organizations to promote regionalized technology transfer actions.

Arrangements – Environmental services in the rural landscape; conservation and sustainable use of bee genetic resources in agroecosystems and impacts on Brazilian agribusiness; strengthening of rainfed family farming systems in the Brazilian semi-arid region; technological innovations for sustainable agricultural production in protected environment; agroecological innovation: knowledge creation and exchange with family agriculture in the Northeast region of Brazil; agroecological systems as an alternative for the development of family farming in the Midwest; monitoring of forest deforestation and degradation and ecosystem services; family agriculture without burning the Amazon; technology generation, improvement, and transfer for sustainable production of coconut and its by-products in Brazil; knowledge creation and exchange for sustainable development of traditional peoples and communities; sustainable diversification of grain production in the lowlands of Rio Grande do Sul; communication network to strengthen the image of Embrapa as a reference in sustainable technologies for the Amazon, among others.

Sustainable technologies and solutions for rural areas have been created, validated, disseminated, and adopted based not only on Embrapa research, but also on partnerships with different sectors and agents in society, such as rural extension, farmers, agro-industries, private companies, governmental organizations (at federal, state and municipal levels) and non-governmental organizations, universities, river basin committees, among others. These theme networks have been working in Brazil and abroad, in an interdisciplinary way, in favor of more sustainable consumption and production based on different methodological approaches and scales of work.

Final considerations

Based on new approaches and understandings of food production multidimensionality, new paths can lead to sustainable consumption and production, providing: increase in production and productivity rates, taking ecosystem support capacity into consideration; knowledge and technologies for greater productive, social, cultural, ecological, and economic system efficiency; agriculture-livestock integration, resulting in more environmentally balanced, nutrient and energy efficient and lower environmentally impacting systems; perception and understanding of dimensions, flows and interactions within production systems and with their surroundings; closer science, agriculture and society interactions in order to answer questions, propose actions and assess sustainably relevant interventions; other social segments better understanding

of agricultural activity, greater appreciation for its social capital and reduction of social and environmental conflicts; placement of humans in agriculture not only as a producer, but also as part of a system that, in addition to producing, plays the role of maintaining the ecological basis and social structure; sound public institutions that can meet the needs of agriculture and citizens; companies with greater social reach, resulting in economic, environmental and social benefits; stronger democracy, with less social conflict.