

*This brief series was developed in preparation for the Foresight Breakout Session of the Global Conference on Agricultural Research for Development (GCARD 2012) and the Global Foresight Hub<sup>1</sup>. The briefs were written to communicate to a wider audience, such as policy makers, civil society organizations, researchers, and funders. The briefs were classified into three categories: Future Studies, Regional Update, and Visioning.*

## Can Brazil feed the world? Not yet, but it has the potential!

José Eustáquio Ribeiro Vieira Filho, Instituto de Pesquisa Econômica Aplicada (IPEA) - Brazil

José Garcia Gasques, Ministério da Agricultura, Pecuária e Abastecimento (MAPA) - Brazil

Alexandre Gervásio de Sousa, Instituto de Pesquisa Econômica Aplicada (IPEA) - Brazil

Based on: Vieira Filho, J. E. R., Gasques, J. G. & Sousa, A. G. (2011). Agricultura e crescimento: cenários e projeções. Discussion Paper, 1642. IPEA; MAPA, Ministério da Agricultura, Pecuária e Abastecimento. (2012). Brasil projeções do agronegócio 2011/2012 a 2021/2022. Assessoria de Gestão Estratégica.

This Brief gives an overview of Brazil's agriculture sector over the past decades, identifying trends and developing scenarios and projections. The Brief sought to report the main conclusions of the book "Brazilian agriculture: performance, challenges and prospects"<sup>2</sup> which presents an extensive analysis of the 2006 Agricultural Census. It also sought to contribute to the planning efforts for a sustainable economic development of the sector.

The projections were estimated by the Ministry of Agriculture (MAPA) and the Brazilian Agricultural Research Corporation (EMBRAPA), with contributions from other researchers and state agencies. The estimates represent the results of a time series analysis, covering 35 years for grains and fewer years for other products. The length of the covered period depended on the availability and quality of information used in the analysis. These projections are calculated every year.

### Brazil's agriculture sector

**Productivity and technology potential.** In 2011, Brazilian agribusiness, which includes the whole chain of food production and distribution, accounted for 22 percent of gross domestic product (GDP). Agriculture represented 70 percent and livestock the remaining 30 percent. The agribusiness sector also contributed positively to the trade surplus of Brazil. Growth in emerging countries (the remaining BRICS countries: Russia, India, China and South Africa) has strongly boosted Brazilian food exports in the last decade. In 2010, while the manufacturing industry experienced a trade deficit of US\$ 26 billion, agribusiness, crop and livestock farming jointly generated a surplus of US\$ 25 billion. The overall trade balance for Brazil was US\$ 10 billion in 2010.

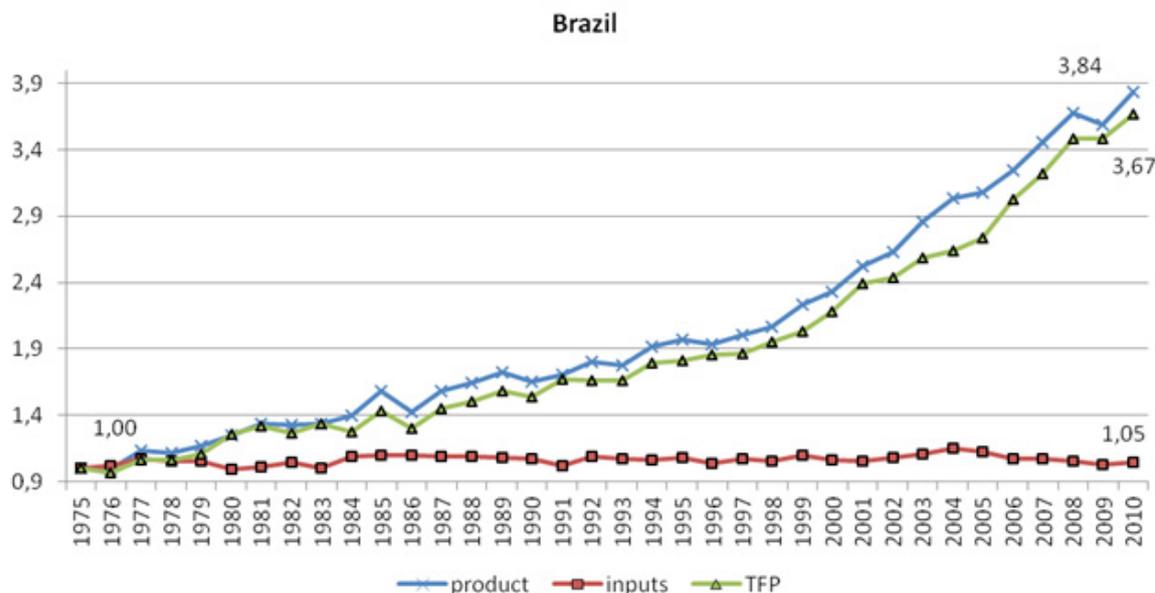
A comparative analysis of agricultural censuses (1970-2006) shows that the number of farms grew sharply until 1980. In addition, land use expanded in new agricultural areas (Center-West). Since then, there has been some stability in the number of farms, standing at 5.1 million in 2006. The reduction of the average area per farm observed since the beginning of the period reflects, among other things, increased productivity of land, achieved through investment in research, science and technology.

<sup>1</sup><http://www.egfar.org/our-work/shaping-future-together/global-foresight-hub>

<sup>2</sup>Gasques, J. G., Vieira Filho, J. E. R. & Navarro, Z. (2010). A agricultura brasileira: desempenho, desafios e perspectivas. IPEA.

According to the Agricultural Census of 2006, conducted by the Brazilian Institute of Geography and Statistics (IBGE), crop and livestock farming occupied 329.9 million hectares, with 158.8 million hectares dedicated to pastures and 59.8 million hectares to crops. Over time the percentage of cropping areas has increased, while areas allocated for pastures have decreased. There is still room for growth in the cattle industry by increasing the number of animals per hectare. An additional 70 million hectares currently dedicated to livestock pastures could be freed for food production. Furthermore, MAPA estimates that Brazil has 90 million hectares of arable land still unexploited.

Mechanization in agriculture has increased, as witnessed by a significant reduction of crop area per tractor. Not only are more vehicles used, but also their power has increased. Mechanization does not necessarily mean a reduction in the number of rural workers. The average number of employees per farm was stable during the period analyzed, with a slight decline shown in recent censuses.



**Figure 1:** Indices representing growth in agricultural production, input use, and total factor productivity - TFP (1975 to 2010); Source: AGE-MAPA (2012)

The technological changes in agricultural production that have occurred in Brazil in recent decades point to growth in productivity. The total factor productivity (TFP), a measure of efficiency in the use of productive factors, has increased by 267 percent since 1975. This indicates a trend of continuous growth in Brazilian agriculture. In the period analyzed, the index for input use (use of labor, capital and land) was stable (only 5 percent growth) while the production index indicates a 284 percent increase in agricultural output. Most of the growth in production is attributed to the growth in technology, showing that it is possible to produce more with fewer resources.

However, most producers have a rather low absorptive capacity of knowledge and thus they do not necessarily benefit from these technology efficiency gains. In addition, they continue to have limited access to new technologies.<sup>3</sup> TFP growth represents the technology efficiency gains for 10 percent of farms (the richest ones), which are responsible for 85 percent of the gross value of production. Therefore, for agricultural development in Brazil, one must incorporate growth with inclusive production for the near future.

**Production vulnerability.** Agricultural production is subject to vulnerabilities at micro- and macroeconomic levels. At microeconomic level, although Brazilian agriculture has experienced tremendous growth in TFP, the absorptive capacity of technology on farms is still very low. According to the Census of Agriculture of 2006, the low education level of the majority of farmers limits their capacity to absorb external knowledge, which discourages growth in productivity.

<sup>3</sup>Absorptive capacity of knowledge is the ability of agents to recognize, assimilate and apply this knowledge to generate technological innovations. For its application to agriculture, see Vieira Filho, J. E. R. & Silveira, J. M. F. (2011). Modelo evolucionário de aprendizado agrícola. Revista Brasileira de Inovação. 10(2), pp.265-300.

Ninety percent of land owners did not have elementary education, and 27 percent were illiterate. These producers do not know how to seek technical guidance on the use of new technology in production, leading them to underuse or inefficiently use such innovations. Only 22 percent of farm managers received some kind of technical assistance in 2006; the large majority (78 percent) did not receive any technical guidance at all. This shows vulnerability in the learning and dissemination of new knowledge.

**Table 1: Farm revenue distribution by income groups (2006)**

Income groups by minimum wage equivalent	Monthly minimum wage equivalent <sup>a</sup>	Number of farms (in thousands)	%	Gross value of annual production (billion)	%
Extreme poverty	(0 a 2]	3,242	69,6	6,5	3,9
Low income	(2 a 10]	960	20,9	18,5	11,1
Medium income	(10 a 200]	416	9,0	59,9	35,9
High income	>200	23	0,5	81,7	49,0
	<b>Total – Brazil</b>	<b>4,641</b>	<b>100,0</b>	<b>166,7</b>	<b>100,0</b>

Source: Agricultural Census – IBGE (2006).

<sup>a</sup> Minimum Wage Equivalent = Monthly gross value of production/ Monthly minimum wage.

Among the macroeconomic vulnerabilities, the high concentration of production stands out (see Table 1). Census data shows that 10 percent of farms (medium and high income) generated 85 percent of the gross value of production (GVP). In contrast, 90 percent of farms (extreme poverty and low income) accounted for only 15 percent of production. Variations between regions and crops indicate a very strong structural heterogeneity in Brazilian agriculture. This heterogeneity makes the widespread implementation of technology<sup>4</sup> more difficult.

Although crop and livestock farming contributes positively to the Brazilian trade balance, the country has become increasingly dependent on imports of technological inputs, resulting in continuous deficits since 2005. For example, in 2010, the negative trade balance for technological inputs reached US\$ 3.7 billion.

Finally, biofuels play an important role in Brazilian agribusiness. However, there are no clear policies to support the ethanol industry. The existing policies often distort market signals and cause misallocation of resources away from biofuels industry. For example, the Brazilian government regulates the price of gasoline at low levels, distorting the relative price of other energy sources. This discourages investment in induced innovation and in biofuels production.

## Key trends and projections

**Production.** The most dynamic agribusiness products are cotton, soybeans, chicken meat, sugar, corn and cellulose. They also have the greatest potential for production growth between 2011/2012 and 2021/2022. Chicken meat production will take the lead (projected increase of 56 percent), followed by coffee (41 percent), apples (36 percent), beef (32 percent), cellulose (30 percent), sugar (26 percent) and soybeans (25 percent). The production of grains (soybeans, corn, wheat, rice and beans) is projected to increase from 153.3 million tons in 2011/2012 to 185.6 million tons in 2021/2022, or around 21 percent. We expect the production of meat (beef, pork and poultry) to increase by 10.9 million tons, or 43 percent.

**Productivity.** Agricultural production in Brazil is expected to continue to grow as a function of productivity. Strong TFP growth will continue. Projections indicate a greater increase in crop and livestock production relative to increase in farmland. For example, grain production is projected to increase by about 21 percent between 2012 and 2022, while the farmland area is expected to expand by only 9 percent.

**Land use.** Estimates until 2021/2022 indicate that the total crop area planted in 2012 will increase by 7 million hectares to reach 71.9 million hectares in 2022. This expansion will be concentrated in soybeans (4.7 million hectares) and sugar cane (over 1.9 million hectares). Soybean- and sugar cane-producing areas will expand through the incorporation of new areas, and replacement of other crops with them.

<sup>4</sup>There is a memorandum of understanding between the Institute for Applied Economic Research (IPEA) and the Economic Commission for Latin America and the Caribbean (ECLAC), under the Project “Inclusive development”, to study the structural heterogeneity of the Brazilian economy. For a study applied to Brazilian agriculture, see Vieira Filho, J. E. R. & Santos, G. R. (2011). Heterogeneidade no setor agropecuário brasileiro: contraste tecnológico. Radar 14 – IPEA, Brasília.

Corn-producing area is projected to increase by approximately 600,000 hectares. Farmland dedicated to the production of rice, cassava, wheat and beans (excluding soybeans) is expected to decrease, with the rest of the crops keeping about the same areas of production.

**Regional and local issues.** The biggest increases in production and area (41 percent) of sugar cane will occur in the State of Goiás, although with low yields. However, in Sao Paulo, the largest producer, high yields will accompany land. Mato Grosso will continue to lead the expansion of soybean and corn production, with expected increases in production above 20 percent. The region called Matopiba (including the Brazilian states of Maranhão, Tocantins, Piauí and Bahia) will experience an increase in grain production, with significant increase in productive area. The projections for this region indicate a production of 20 million tons of grain in 2022 (growth of 28 percent) and a planted area between 7 and 10 million hectares by the end of the period. Lands in this region are particularly suitable for modern agriculture. They are flat and large, with potentially productive soils, water availability, and ideal climate with long days and sunlight. The major limitation, however, is the poor condition of infrastructure (transport logistics, communication and financial services).

**Domestic consumption and exports.** Although we project a strong growth in Brazilian exports in the coming years, the domestic market will remain an important growth factor. In 2021/2022, 56 percent of the soybean production, 84 percent of the maize production, 63 percent of poultry production, and 80 percent of beef and pork production will be destined for the domestic market. With respect to exports, in 2021/2022 Brazilian soybean exports are expected to account for 43 percent of the world soybean exports, beef for 23 percent of the world beef exports and poultry for 44 percent of the world poultry exports. There is thus a double pressure to increase domestic production, due to the growth of the internal market and exports. In addition, we expect Brazil to maintain its leadership in world trade in coffee and sugar. Brazil will be among the largest producers and exporters of food and may become the first in some relevant products for worldwide consumption. There is no doubt that Brazil will be a major player in global agricultural production.

## Impact

The major impact of the study was, and continues to be, its influence on the development of the strategic planning of the Ministry of Agriculture (MAPA), whose mission is to promote sustainable development and competitiveness of Brazilian agribusiness. The projections developed provides guidance to MAPA, and furthermore, the study contributes to the knowledge necessary to formulate public policies designed to promote economic growth and strengthen the social and environmental impacts of small, medium and large crop and livestock farming production. For example, our study should help in designing minimum price policies, managing food-security reserves, and managing guaranteed domestic food supplies

## Lessons learned

Agricultural production in Brazil has undergone technological changes that have increased productivity and gains in efficiency in resource use. However, the structural heterogeneity of production remains a limiting factor in the modernization process. This observation repositions the public policies by adding the themes of growth and income distribution. The projections of Brazilian agribusiness can serve as relevant information for planning and advocacy in the Brazilian agricultural sector. However, they will only be used if they are reliable. In order to obtain reliable projections, it is necessary to conduct various tests, comparing the expected value with the observed. The tests show a high hit rate, except for the variable export (which is naturally more unstable). To minimize error and incorporate new trends, projections should be reviewed annually.

## Citation:

Vieira Filho, J.E.R, Gasques, J.G. and Sousa, A.G. 2012. Can Brazil feed the world? Not yet, but it has the potential! *The Futures of Agriculture*. Brief No. 33 - English. Rome: Global Forum on Agricultural Research (GFAR).

## Contact information:

José Eustáquio Ribeiro Vieira Filho (jose.vieira@ipea.gov.br); the Brief series coordinator Robin Bourgeois (Robin.Bourgeois@fao.org).

## License Disclaimer:

Creative Commons Attribution & Noncommercial License (BY-NC). Licensees may copy, distribute, display and perform the work and make derivative works based on it only for noncommercial purposes and if they give the author or licensor the credits in the manner specified by these.