

## *China and the Soybean Challenge*

Some 3,000 years ago, farmers in eastern China domesticated the soybean. In 1765, the first soybeans arrived in North America, but they did not soon catch on as a crop. For 150 years or so the soybean languished as a curiosity in gardens.<sup>1</sup>

Then in the late 1920s, a market for soybean oil began to develop, moving the soybean from the garden to the field. During the 1930s, soybean production in the United States climbed from 400,000 tons to over 2 million tons. And as growth in the demand for the oil gained momentum, soybean production jumped to over 8 million tons in 1950.<sup>2</sup>

During the 1940s and early 1950s, the soybean crop was harvested and crushed primarily for the 20 percent of the bean that was oil. Then during the 1950s, the demand for meat, milk, and eggs climbed. With little new grassland to support expanding beef and dairy herds, farmers started feeding their animals more grain supplemented with soybean meal in order to produce more beef and milk. Farmers were already relying heavily on grain to produce pork, poultry, and eggs. By 1960 soybean meal had become the primary product of soybean crushing and oil the secondary one. For the first time, the value of the meal exceed-

ed that of the oil, an early sign of things to come in the changing role of the soybean.<sup>3</sup>

This rise in the demand for soybean meal reflected the discovery by animal nutritionists that combining 1 part soybean meal with 4 parts grain, usually corn, in feed rations would sharply boost the efficiency with which livestock and poultry converted grain into animal protein. This was the soybean's ticket to agricultural prominence, enabling it to join wheat, rice, and corn as one of the world's four leading crops.<sup>4</sup> (See Figure 9–1.)

Although the soybean had originated in China, it found a welcome home in the United States. In its new role as a source of high-quality protein for mixing in animal feeds, it was destined to become an integral part of the U.S. farm economy.<sup>5</sup>

After World War II, U.S. production of the soybean soared, bringing China's historical dominance of soybean production to an end. By 1960, the U.S. harvest was close

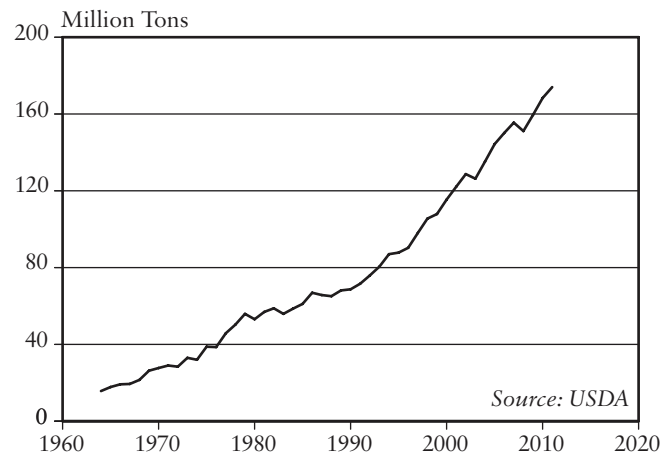


Figure 9–1. *World Soybean Meal Use for Feed, 1964–2011*

to triple that in China. By 1965, the United States was producing three fourths of the world's soybeans and accounting for virtually all the exports.<sup>6</sup>

When world grain and soybean prices spiked in the mid-1970s following the 1972 Soviet crop failure, the United States—in an effort to curb domestic food price inflation—embargoed soybean exports. Japan, a leading importer, was soon looking for another supplier. And Brazil was looking for new crops to export. The rest is history, as Brazil became a leading soybean exporter.<sup>7</sup>

Neighboring Argentina, a leading exporter of wheat and corn, also recognized the market potential for soybeans. Once the soybean gained a foothold in Argentina, production there expanded rapidly, making it the third of the big three soybean producers and exporters.<sup>8</sup>

The main soybean producers today, in round numbers, are the United States at 80 million tons, Brazil at 70 million tons, and Argentina at 45 million tons. Together they account for over four fifths of world soybean production. China is a distant fourth at a mere 14 million tons. For six decades, the United States was both the leading producer and exporter of soybeans, but in 2011 Brazil's exports narrowly eclipsed those from the United States.<sup>9</sup>

Throughout most of this period, the United States was also the leading soybean consumer. As recently as 1990, U.S. soybean consumption was quadruple that in China, but in 2008 China took the lead. By 2011 China was consuming 70 million tons of soybeans a year, well above the 50 million tons in the United States.<sup>10</sup>

As China's appetite for meat, milk, and eggs has soared, so too has its use of soybean meal. And since nearly half the world's pigs are in China, the lion's share of soy use is in pig feed. Its fast-growing poultry industry is also dependent on soybean meal. In addition, China now uses large quantities of soy in feed for farmed fish.<sup>11</sup>

Four numbers tell the story of the explosive growth of soybean consumption in China. In 1995, China was producing 14 million tons of soybeans and it was consuming 14 million tons. In 2011, it was still producing 14 million tons of soybeans—but it was consuming 70 million tons, meaning that 56 million tons had to be imported.<sup>12</sup> (See Figure 9–2.)

China’s neglect of soybean production reflects a political decision made in Beijing in 1995 to focus on being self-sufficient in grain. For the Chinese people, many of them survivors of the Great Famine of 1959–61, this was paramount. They did not want to be dependent on the outside world for their food staples. By strongly supporting grain production with generous subsidies and essentially ignoring soybean production, China increased its grain harvest rapidly while its soybean harvest languished.<sup>13</sup>

Hypothetically, if China had chosen to produce all of the 70 million tons of soybeans it consumed in 2011,

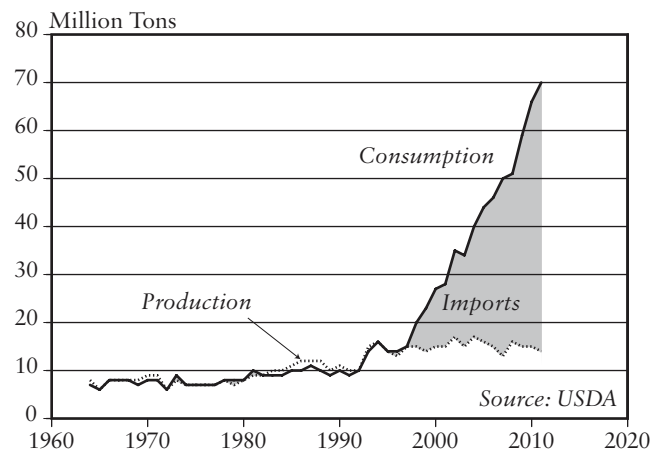


Figure 9–2. Soybean Production, Consumption, and Imports in China, 1964–2011

it would have had to shift one third of its grainland to soybeans, forcing it to import 160 million tons of grain—more than a third of its total grain consumption. Because of this failure to expand soybean production over the last 15 years or so, close to 60 percent of all soybeans entering international trade today go to China, making it far and away the world’s largest importer. As more and more of China’s 1.35 billion people move up the food chain, its soybean imports will almost certainly continue to climb.<sup>14</sup>

Only one tenth of the soybeans used in China is consumed directly as food such as tofu and soy sauce. The other 90 percent is crushed, separating the oil and meal. In China, as elsewhere, the oil is a highly valued cooking oil and the meal is widely used in animal feed rations.<sup>15</sup>

For the world as a whole the pattern of soybean consumption is similar. To most consumers, the soybean is an invisible food, one that is embodied in many of the products found in any refrigerator. Clearly, the soybean is far more pervasive in the human diet than the visual evidence would indicate.<sup>16</sup>

The world demand for soybeans is increasing by some 7 million tons per year. It is being driven primarily by the 3 billion people who are moving up the food chain, consuming more grain- and soybean-intensive livestock products. Population growth is also driving up the demand for soybeans, either indirectly through the consumption of livestock products or directly through the consumption of tofu, miso, and tempeh. In the two leading consumers of soybeans, the United States and China, populations are growing by 3 million and 6 million per year, respectively. And finally, an increasing demand for soy oil for biodiesel is also ramping up soybean use.<sup>17</sup>

The principal effect of soaring world soybean consumption has been a restructuring of agriculture in the western hemisphere. In the United States there is now

more land in soybeans than in wheat. In Brazil, the area in soybeans exceeds that of all grains combined. Argentina's soybean area is now close to double that of all grains combined, putting the country dangerously close to becoming a soybean monoculture.<sup>18</sup>

For the western hemisphere as a whole, the fast-expanding area planted to soybeans overtook that in wheat in 1994. As of 2010, there was more than twice as much land in soybeans as in wheat. The soybean eclipsed corn in area in 2001.<sup>19</sup> (See Figure 9–3.)

Satisfying the climbing global demand for soybeans poses a huge challenge. Since the soybean is a legume, fixing atmospheric nitrogen in the soil, it is not as fertilizer-responsive as, say, corn, which has a ravenous appetite for nitrogen. And because the soy plant uses a portion of its metabolic energy to fix nitrogen, it has less energy to produce seed. This makes raising yields difficult.<sup>20</sup>

Since the mid-twentieth century, the world grain har-

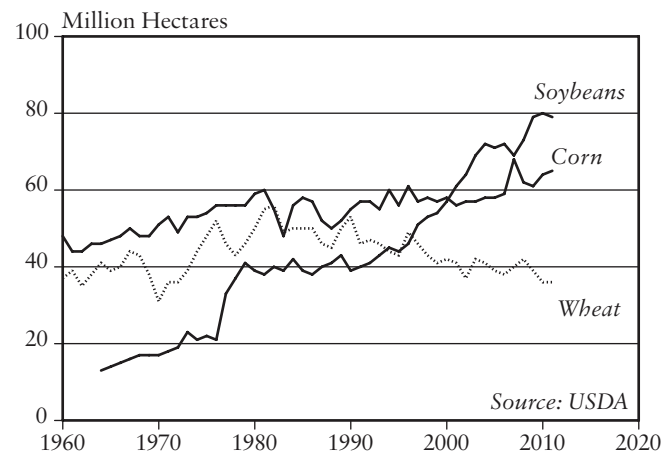


Figure 9–3. Land in Corn, Wheat, and Soybeans in the Western Hemisphere, 1960–2011

vest has nearly quadrupled, with most of this growth coming from the tripling of the grain yield per acre. But the 16-fold increase in the global soybean harvest has come overwhelmingly from expanding the cultivated area. While the area expanded nearly sevenfold, the yield scarcely doubled. The world gets more soybeans primarily by planting more soybeans. Therein lies the problem.<sup>21</sup>

The question then becomes, Where will the soybeans be planted? The United States is now using all of its available cropland and has no additional land that can be planted to soybeans. The only way to expand soybean acreage is by shifting land from other crops, such as corn or wheat.

In Brazil, new land for soybean production comes from the Amazon Basin or the *cerrado*, the savannah-like region to the south. Both the Amazon Basin and the *cerrado* are home to staggering levels of biodiversity, with many plant and animal species that can be found nowhere else on earth. Beyond this, both the regions store immense quantities of carbon, so new land clearing means not only lost biodiversity but also increased carbon emissions, exacerbating climate change for the entire world.<sup>22</sup>

The Amazon Basin and the *cerrado* are also integral to the hydrological cycle. The Amazon rainforest recycles rainfall from the coastal regions to the continental interior, ensuring an adequate water supply for agriculture not only in Brazil's west and southwest but also in Paraguay and northern Argentina. And many of Brazil's rivers originate in the *cerrado*.<sup>23</sup>

Unfortunately, land clearing has already taken a devastating toll on the Amazon Basin and the *cerrado*. Since 1970, the forested area in the Amazon Basin has shrunk some 19 percent from its 400 million hectares. For the *cerrado*, it is estimated that roughly half of its original 200 million hectares has been lost. In both cases, soybean expansion has played a significant role.<sup>24</sup>

In the *cerrado*, soybean farmers typically clear the land themselves. In the Amazon Basin, in contrast, they often purchase already deforested land from cattle ranchers. The ranchers in turn move further into the Amazon, clearing new land for their cattle. The cycle continues.<sup>25</sup>

Some progress is being made in curbing land clearing in the Amazon Basin. Over the past decade in Mato Grosso, a large state on Brazil's agricultural frontier that produces nearly a third of the country's soybeans, deforestation slowed dramatically while soybean production increased rapidly.<sup>26</sup>

Part of this reduction was due to government initiatives, such as restricting access to credit for deforesters, and a satellite monitoring system that provided information on when and where deforestation was occurring. This evidence in near real time proved to be a strong deterrent to deforestation. At the same time, a coalition of environmental groups pressured major soybean buyers to adopt a moratorium on purchasing soybeans produced on deforested land.<sup>27</sup>

Unfortunately, if world soybean consumption continues to climb at a rapid rate, the economic pressures to clear more land could become intense. And if the additional land to meet the expanding demand is not in Brazil, where will it be? Where will the new land for soybeans come from?

Although the deforestation is occurring within Brazil, it is being driven by the worldwide growth in demand for meat, milk, and eggs. Put simply, saving the Amazon rainforest now depends on curbing the growth in demand for soybeans by stabilizing population worldwide as soon as possible. And for the world's more affluent population, it means eating less meat and thus slowing the growth in demand for soybeans. Against this backdrop, the recent downturn in U.S. meat consumption is welcome news.<sup>28</sup>