



## Economic Report

Office of Regulatory Policy

Agricultural and Economic Policy Team

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### Summary

Grain and soybean prices have dropped sharply since their peak in 2012. One factor contributing to their decline has been a significant overhang of stocks due to record large crops.

Global production of corn, soybeans, and wheat have increased substantially since 2005 because of higher yields and increased area harvested. Since 2005, yields have increased 14 to 19 percent for these crops. And harvested acres have increased 23 percent for corn and 31 percent for soybeans but only 1 percent for wheat.

The United States and China produce about 60 percent of the world's corn crop, while the United States, Brazil, and Argentina grow over 80 percent of the world's soybeans. The EU, China, and India account for nearly half of global wheat production.

World production of these crops has exceeded consumption in 8 of the past 12 years, leading to the large supplies we have today.

Studies indicate that the outlook for feeding the world's growing population is favorable given continued gains in productivity.

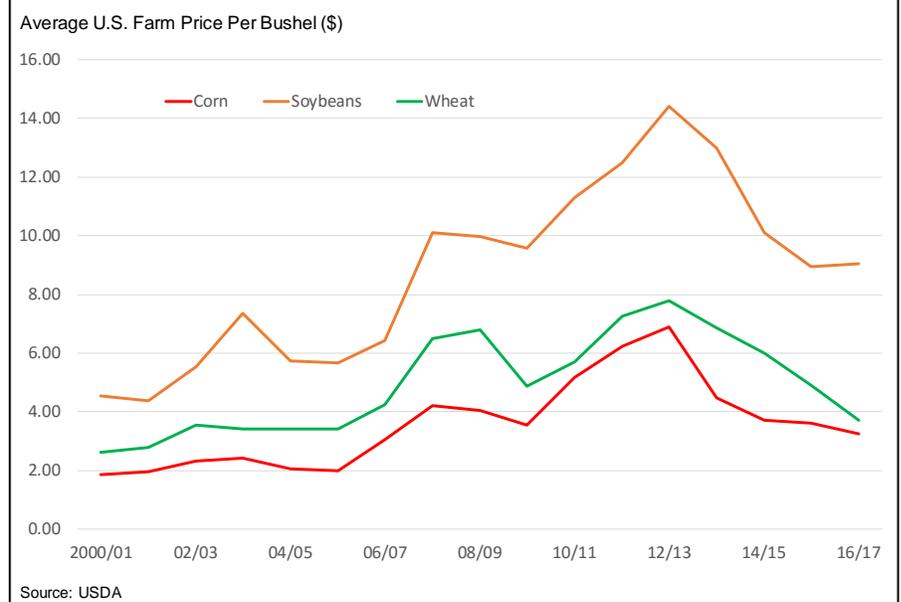
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# The Malthusian Miscalculation: A World Awash in Grains and Soybeans

The prices of grains and soybeans have declined sharply in recent years. Since peaking in 2012, corn and wheat prices have declined over 50 percent and soybean prices have dropped nearly 40 percent. See figure 1.

Factors contributing to this sharp drop in grain prices include the leveling off of the growth in demand for corn for ethanol production, slowing world economic growth, and a significant increase in the global production of grains and soybeans.

**Figure 1. Crop Prices Adjust to Reflect Supply and Demand Conditions**



In 1798, in "An Essay on the Principle of Population," Thomas Robert Malthus famously wrote, "The power of population is indefinitely greater than the power in the earth to produce subsistence for man."

Of course, Malthus could not have anticipated the improvements in plant genetics that plant breeding and biotech developments have made possible; these have contributed to the growth in yields around the globe. Also, in addition to the increased mechanization of agriculture, the use of "Big Data" and geo-positioning technology has also begun enhancing productivity in ways that could not have been predicted over 200 years ago.

It is reasonable to expect that global production capacity will continue to grow as crop science advances and more productive technologies become more widespread.

This report will focus on the recent growth in the production of corn, wheat, and soybeans. It will discuss the increase in yields and area harvested, and it will identify the countries experiencing the greatest growth.

**Global soybean and corn production has grown rapidly since 1990; wheat lags**

The global production of soybeans has more than tripled since 1990, increasing from 104.3 million metric tons in 1990 to 333 million metric tons in 2016. Since 2005 soybean production has grown about 50 percent.

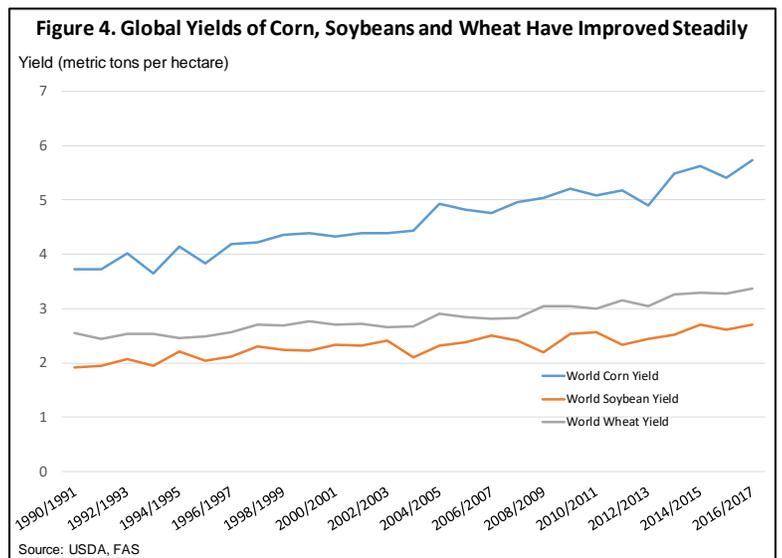
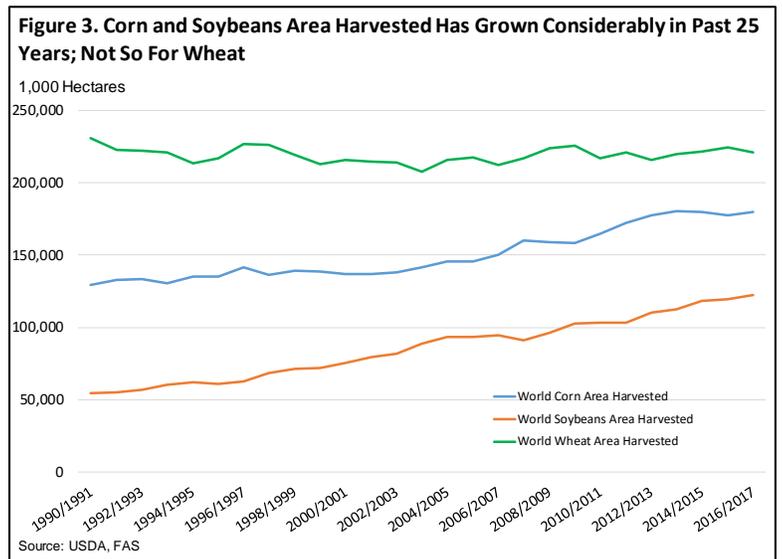
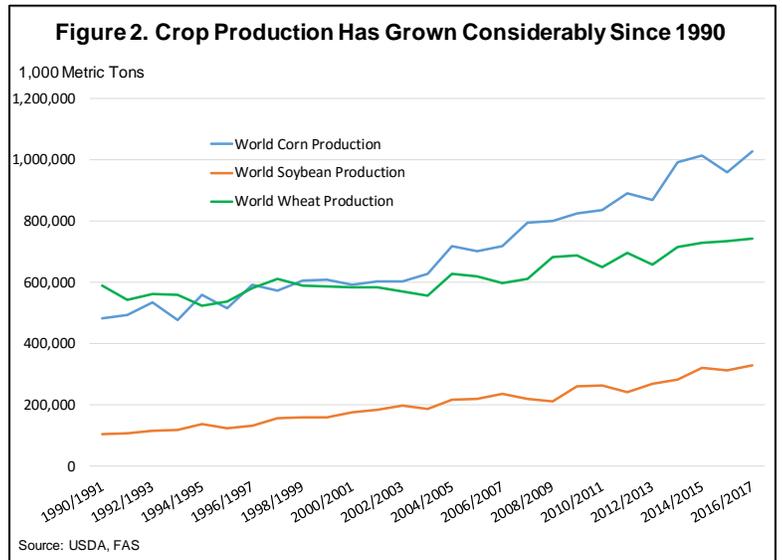
Corn has a similar, if not quite as dramatic, story. Worldwide corn production has more than doubled since 1990, increasing from 482 million metric tons to over a billion metric tons in 2016. The increase since 2005 has been about 47 percent.

Wheat production, however, has not experienced the rapid rise that corn and soybeans have had. Wheat production had little, if any, growth from 1990 to 2003. Since 2005, global wheat production has increased about 20 percent.

**Wheat area stagnates as corn and soybeans grow**  
Global wheat area harvested has increased only about 1 percent since 2005. However, corn and soybean areas have grown 23 percent and 31 percent, respectively, during this period. In the United States, improved genetics of corn and soybeans, as well as the introduction of biotech varieties, has allowed these crops to be planted further north and west, leading to expanded harvested area. Corn and soybean area is frequently expanded at the expense of wheat because corn and soybeans are more profitable. This is likely the case in other countries as well.

**Yield improvement has also contributed to the growth in production worldwide**

Improved seed and agronomic practices have led to steady increases in yields for corn, soybeans, and wheat. Since 2005, yields have increased 19 percent for corn and wheat and 14 percent for soybeans. So despite almost no increase in wheat area harvested, higher yields have resulted in greater production of this important food grain.



### World corn supplies are ample

Good weather conditions in the United States and around the world have led to large corn crops and substantial supplies relative to use. In the 2016/17 crop year, the global stocks-to-use ratio stood at nearly 22 percent, its highest level in 15 years.

It's been four years since the 2012 U.S. drought and one can reasonably expect that poor weather will occur in the United States or some other major production region sometime in the next few years. This would likely pull supplies down and, if severe, could cause a spike in prices. However, as we have seen in the recent episode, farmers have the capacity to ramp up production and replenish supplies quickly.

### The U.S. and China are the dominant corn producers

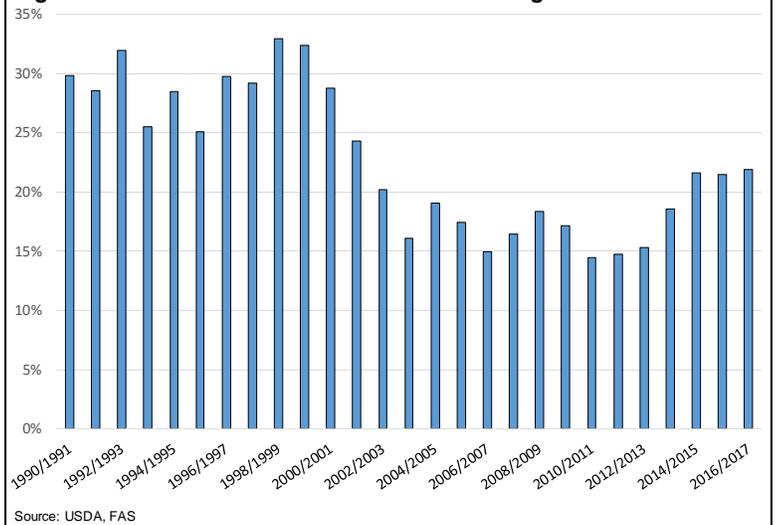
The United States and China account for nearly 60 percent of the corn produced in the world. The United States is also by far the world's largest exporter of corn, followed by Brazil, Argentina, and Ukraine. In 2016, the United States is projected to produce about 382 million metric tons of corn. This is followed by China with 216 million and Brazil with 83 million. Despite its large corn crop, China exports very little corn each year.

### Both yields and area harvested have increased in many countries

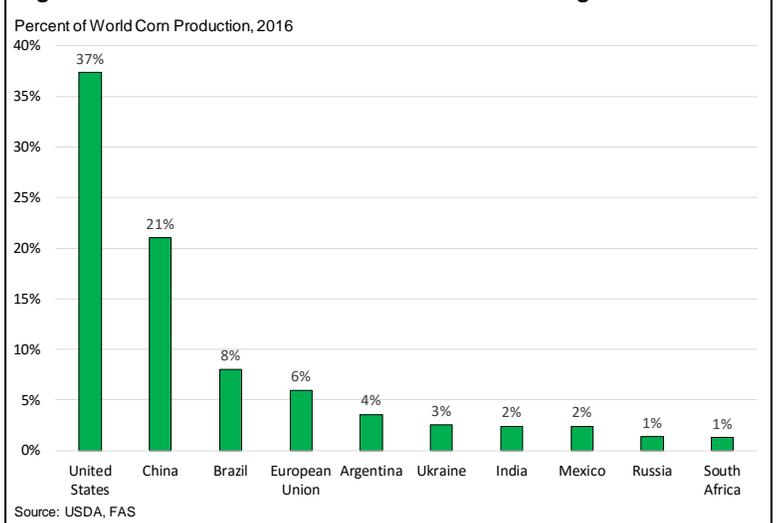
Many countries responded to the run-up in grain prices that began in 2006 by increasing the amount of land planted to corn and other grains and oil-seeds. This was particularly true in Russia and Ukraine where corn area harvested increased 250 percent and 156 percent, respectively. World corn area harvested increased 34.6 million hectares from 2005 to 2016. China accounted for 28 percent of the increase, followed by Brazil with 13 percent and the United States with 10 percent.

Yields also rose during this period. For the 10 leading producers, the growth in yields ranged from 5 percent in the European Union to 42 percent in Ukraine and 57 percent in Brazil.

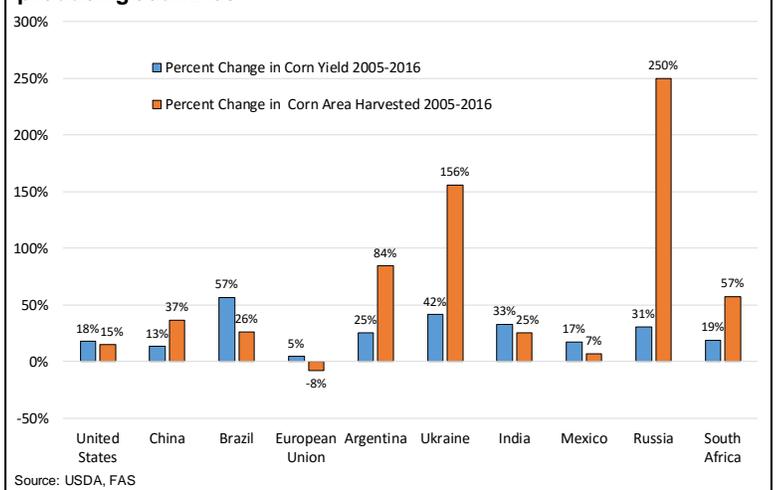
**Figure 5. Global Corn Stocks/Use Ratio is The Highest in Fifteen Years**



**Figure 6. The U.S. and China Are The World's Leading Corn Producers**



**Figure 7. Both yield and area have increased in most leading corn producing countries**



### Global soybean stocks/use ratio down from recent highs

The 2016 soybean stocks/use ratio is down from the high level reached in 2014 and a few previous years thanks to strong demand from China. However, supplies relative to use are still quite high compared to the 1980s and 1990s.

China is, by far, the world's largest consumer of soybeans, with domestic consumption accounting for about 30 percent of total world consumption as well as about 30 percent of total world production. China imports soybeans to make soybean meal for feed for its hog and poultry sectors and soybean oil for cooking.

### The U.S., Brazil, and Argentina are the leading producers and exporters of soybeans

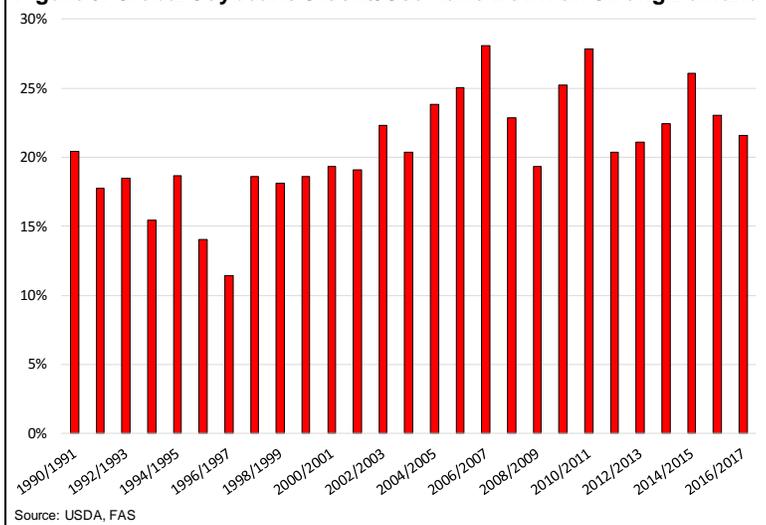
The United States, Brazil, and Argentina account for more than 80 percent of global soybean production. They also dominate soybean exports, with Brazil taking over the number one position from the United States in 2012.

### Soybean yields and area increased in most top-producing countries

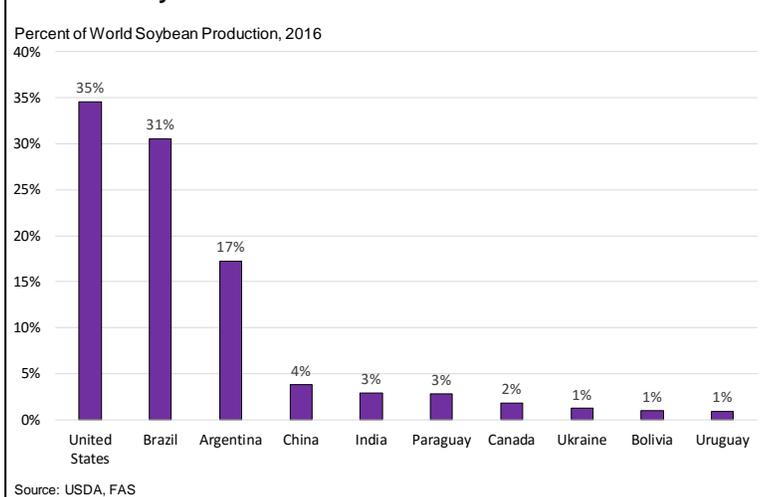
Soybean area harvested has increased 28.7 million hectares since 2005. Brazil accounts for about 40 percent of this increase, with the United States, Argentina, and India contributing another 44 percent. Ukraine added about 1.4 million hectares to soybean area, resulting in a huge percentage rise. Soybean production in Ukraine has risen sharply to meet the country's growing demand for feed for its expanding livestock industry, primarily hogs and poultry. Soybean area in Uruguay began growing rapidly in the early 2000s from fairly low levels because of high soybean prices in the mid-2000s and investment by Argentine producers.

Among the top-producing countries, yield increases from 2005 to 2016 have ranged from 4 percent in China to 77 percent in Paraguay. Yields declined a bit in India and Canada during this period.

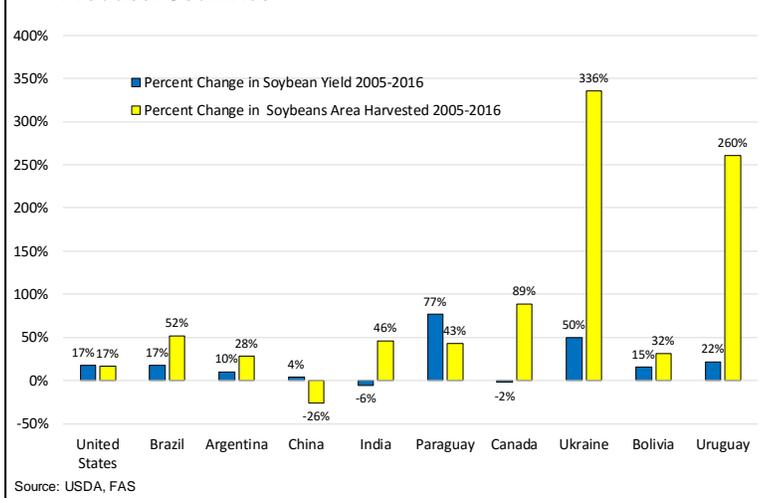
**Figure 8. Global Soybeans Stocks/Use Ratio Down on Strong Demand**



**Figure 9. The U.S., Brazil and Argentina Account For Over 80 Percent of Global Soybean Production**



**Figure 10. Soybean Yields Have Risen in Most of the Leading Producer Countries**



**Global wheat supply relative to use is at its highest level in 15 years**

Total global ending stocks of wheat are projected to be about 248 million metric tons in 2016, with China accounting for 48 percent of the total, followed by the United States with 12 percent. Global wheat stocks have grown about 62 percent since 2005, led by China, the United States, and India. China maintains large supplies of wheat to ensure its food security. The largest consumers of wheat are the EU at 18 percent, China at 16 percent, and India at 13 percent of world consumption.

**Nearly half of the global wheat crop is produced in the EU, China, and India**

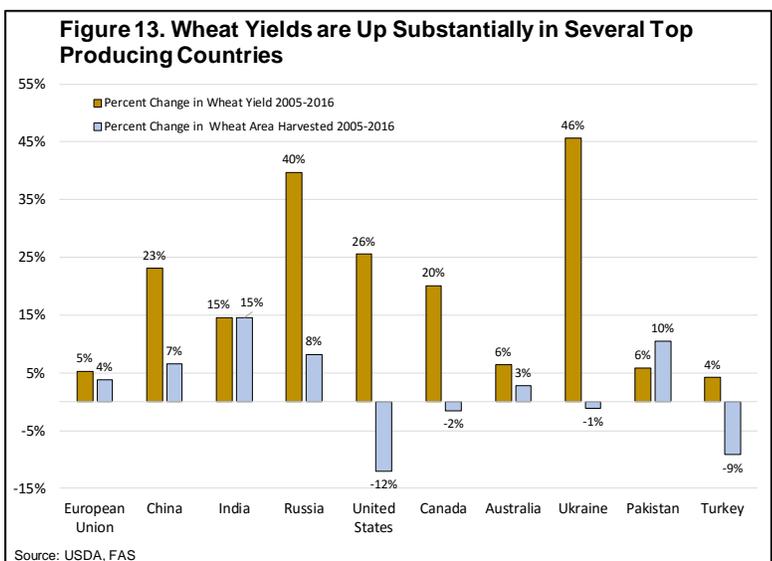
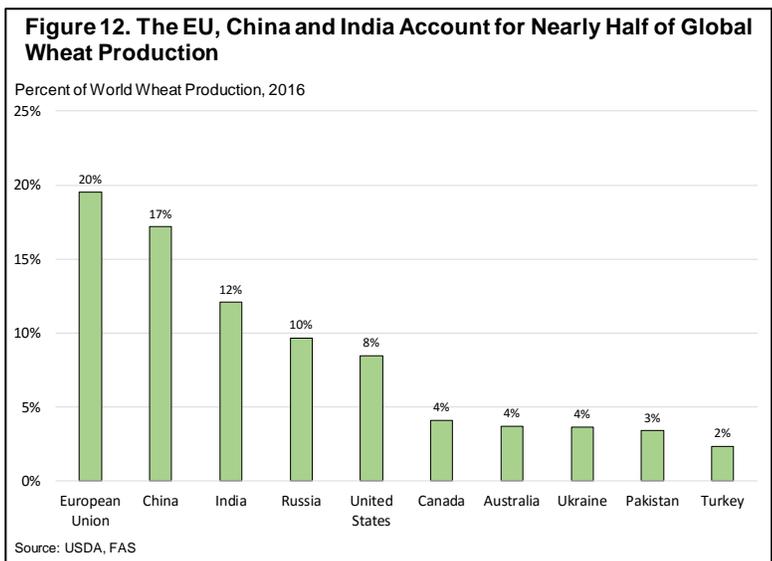
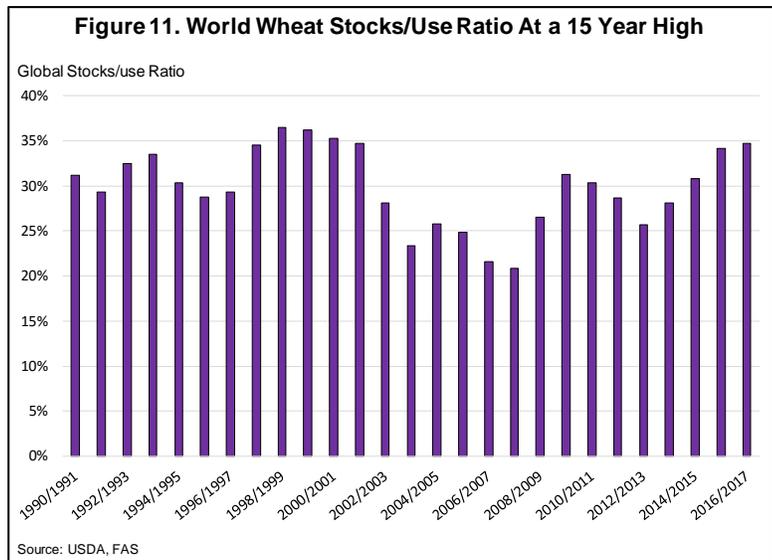
The EU, China, and India have consistently been the first-, second-, and third-largest wheat producers in the world for at least the past 15 years. Since 2005, wheat production has increased considerably in Russia and the Black Sea region. Wheat production is up 51 percent in Russia and roughly 45 percent in Ukraine and Kazakhstan. Both China and India have seen wheat production rise 31 percent during this period.

In 2016, Russia, the United States, the EU, Canada, and Australia are projected to be the leading wheat exporters, in that order. They will account for 71 percent of global wheat exports.

**Several leading wheat-producing countries experienced much higher yields since 2005**

Improved plant genetics, combined with better and more intensive farming practices, has resulted in much higher yields in Russia and Ukraine. China has also had increased wheat yields since 2005. In fact, China's wheat yields are among the highest in the world, second only to the EU. China is able to achieve these high yields through extensive irrigation.

Globally, there are about 222 million hectares of wheat projected to be harvested in 2016, up just 4.6 million from 2005. Of the top-producing countries, India experienced the greatest growth in wheat area since 2005, up 15 percent. India also has the most wheat area at 30 million hectares, followed by the EU, Russia, China, and the United States.

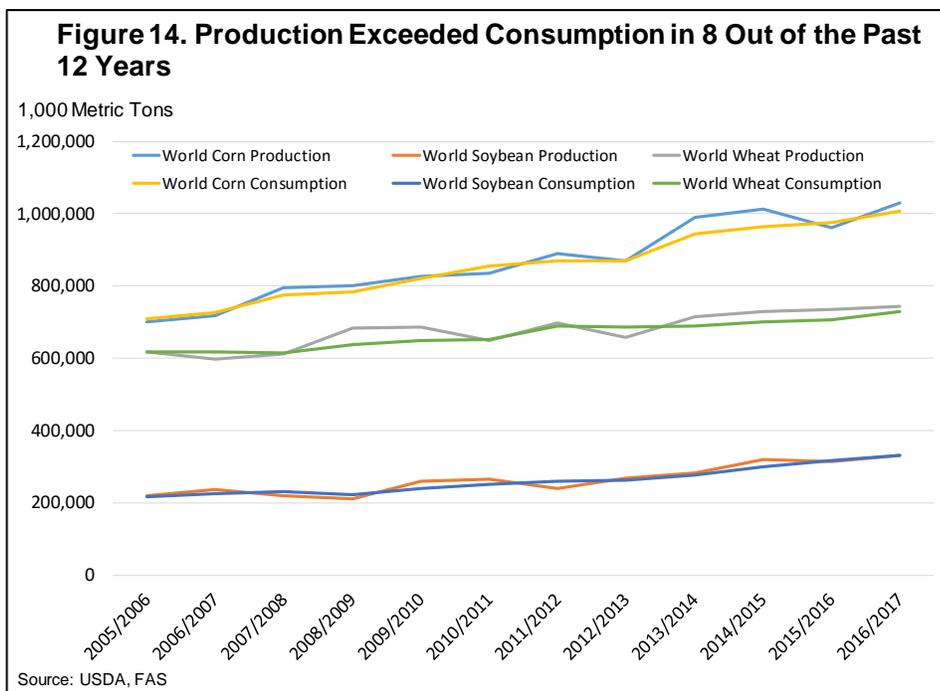


### Has production kept up with growing consumption?

Since 2005, the production of corn, soybeans, and wheat has exceeded consumption in 8 out of the past 12 years. The excess production did not occur during the same years for each crop. Nevertheless, since 2005, cumulative global production has exceeded consumption by 129.7 million metric tons for corn, 35.8 million metric tons for soybeans, and 131.8 million metric tons for wheat, leading to the large supplies we have today.

### Can future production satisfy the demands of 9 billion people in 2050?

The short answer is a qualified yes based on expectations of continued gains in productivity. It's a qualified yes because there are risks associated with any long-term projection. However, studies conducted over the past few years point to the likelihood that we will produce enough food to feed a growing world population.



A 2012 Food and Agriculture Organization (FAO) study indicated that about 85 percent of the increased production over the next 40 years will come from improved yields.<sup>1</sup> FAO acknowledges that there are risks associated with its projections but concludes that “evidence cautiously suggests that, at the global level, agricultural production can be increased enough to satisfy the additional demand projected to 2050.” FAO assumes there will be sufficient investment and policy support in the agricultural sector to enhance yields and provide for needed infrastructure and institutions. Nevertheless, there will still be areas of undernourishment in the poorest countries.

Another 2014 study by the Australian Centre for International Agricultural Research concluded much the same. According to the study’s authors, “no calamity is foreseen—but there is no room for complacency, especially of the kind invoked by some advocates of biotechnology. Multidisciplinary agricultural science remains the key to success. With complementary investment in infrastructure and institutions, and relative freedom from civil unrest, the world should manage to sufficiently feed its growing population.”<sup>2</sup>

### Concluding remarks

The ghost of Malthus continues to lurk in the halls of some organizations. And his followers emerge from time to time to warn us of our impending doom. But the ingenuity of humanity continues to provide the technological advancements necessary to feed our growing population.

<sup>1</sup> Food and Agriculture Organization. Agricultural Economics Development Division. 2012. Summary, [World Agriculture Towards 2030/2050: The 2012 revision](#).

<sup>2</sup> Fischer R.A., Byerlee D. and Edmeades G.O. 2014. [Crop yields and global food security: Will yield increase continue to feed the world?](#) ACIAR Monograph No. 158. Australian Centre for International Agricultural Research: Canberra. xxii + 634 pp.