



Characteristics and Trends of U.S. Soybean Production Practices, Costs, and Returns Since 2002

Kate Vaiknoras and Todd Hubbs

What is the Issue?

Soybean is a major U.S. crop, with 87 million planted acres in 2022, making it the second-most planted crop after corn. Soybean is a key source of livestock feed and also an export crop. The U.S. soybean industry has grown over the past two decades in terms of acreage, yield, and production. Many factors influencing soybean production and soybean markets have changed since the last major USDA, Economic Research Service (ERS) report that examined the crop. These factors include technology and production practices, export demand, environmental concerns, public policies, and weather events. This report contributes to the literature on U.S. crop farming by identifying major trends in soybean farming in recent decades and examining their causes and implications. The report also analyzes how costs, returns, and productivity have evolved in response to shifting prices and production practices.



What Did the Study Find?

Over the past two decades, U.S. soybean acreage, yields, and exports increased while prices trended upward:

- Soybean planted acreage grew 18 percent between 2002 and 2022. While planted acreage lagged that of corn in most years, soybean acreage grew at a faster rate than corn during the period.
- U.S. soybean exports increased over time as a share of total U.S. production but fell in 2018 due to trade restrictions. In the 2017/18 marketing year, which runs each year from September to August, exports were 48.4 percent of production, but the following year fell to 39.6 percent. Soybean prices and acreage also fell that year. Soybean exports quickly rebounded, and in 2020/21, equaled 53.7 percent of production.
- Yield trended upward but was affected by pest and weather events, including aphid infestations in 2003 and a drought in 2012.
- Prices trended upwards over the past two decades but there was fluctuation between years. Nominal soybean prices peaked in 2012 at \$14.40 per bushel.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

Soybean production has become more input intensive and the adoption of new technologies has expanded:

- Genetically engineered seed varieties became commercially available in 1996. Adoption of herbicide-tolerant genetically engineered soybean varieties was nearly universal by 2006. The most common type of seed is tolerant to glyphosate, a widely used herbicide.
- Demand for other herbicides, such as dicamba, has grown due to the spread of glyphosate-resistant weeds. Dicamba-tolerant soybean varieties became commercially available in 2016. By 2018, 43 percent of soybean acres in the United States were planted with dicamba-tolerant seed, though the acres were not all treated with dicamba.
- A greater share of soybean acres were treated with fertilizer, insecticide, and fungicide in 2018 than in 2002, while the use of precision agriculture technology also grew. Usage varies by region.

Costs of soybean production, as well as net returns and productivity, have changed over time:

- Changing soybean production practices contributed to an increase in the cost of producing an acre of soybeans, as well as yields, and productivity. The unit cost of producing a bushel of soybeans, adjusted for inflation, fell from \$10.21 in 2002 to \$9.07 in 2018. Of the years 2002, 2006, 2012, and 2018, this cost was lowest in 2006 at \$8.93 per bushel.
- From 2002 to 2022, net financial returns were highest in 2012—a major drought year when soybean prices were relatively high, and lowest in 2019, a year when soybean prices were relatively low. Net soybean returns were positive in more years than for corn and wheat, which may explain the growth in soybean acreage relative to those crops.

How Was the Study Conducted?

This study uses data from USDA, National Agricultural Statistics Service (NASS) on soybean acreage, prices, and yields from 2002 to 2022 and from the U.S. Census of Agriculture in 2002, 2007, 2012, and 2017 to summarize broad trends in the U.S. soybean industry from the past two decades. The study also uses data from USDA, ERS *Oil Crops Yearbook* from 2002 to 2022 to describe the increase in U.S. soybean exports during that period. Data from the USDA, ERS and USDA, NASS Agricultural Resource Management Survey (ARMS) of soybean fields from the years 2002, 2006, 2012, and 2018 are used to examine changes in technology used in soybean production over time and by region. The ARMS provides nationally representative information on production practices and input use on soybean fields. Finally, data from the annual USDA, ERS Commodity Costs and Returns estimates from 2002/22 are used to analyze changes to costs and returns to soybean production, as well as economies of size and productivity in soybean production. Much of the data are summarized for the major soybean-producing regions.