



## Briefing Rooms

### Corn: Market Outlook

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#### USDA Feed Grains Baseline, 2005-14

The gross domestic product is expected to grow in the United States and around the world, raising incomes and boosting demand for meat. A growing livestock industry will need increasing supplies of feed grains. A ban on methyl tertiary butyl ether (MTBE) in some States is boosting the use of ethanol in gasoline to comply with the Clean Air Act's requirement for oxygenates in the fuel. The majority of ethanol is made from grains, creating an increasing use for feed grains. Estimated net returns per acre are expected to be more favorable for corn than for other feed grains. As a result, acres planted to corn, the primary feed grain in the United States, are forecast to increase slightly. In contrast, plantings of oats may remain unchanged, but sorghum and barley acres may decline. The effect of these changes, as well as other factors, on the U.S. feed grains sector are evaluated in preparation of the Department's 10-year baseline projection.

Each year, USDA updates its 10-year projection of supply and utilization of major field crops grown in the United States, including feed grains ([see Overview of the USDA Baseline Process](#)). The commodity projections are used to forecast farm program costs and to prepare the President's budget. One key use of the projections is as a "baseline" from which to analyze the impacts of potential policy changes affecting U.S. agriculture. This discussion briefly summarizes the analysis underlying the feed grain projections for 2005-14. Details about the baseline projections for the U.S. macroeconomy, other U.S. crops, U.S. livestock, the U.S. agricultural sector, and global agricultural trade can be found in the [Agricultural Baseline Projections](#) briefing room.

The U.S. feed grain sector is expected to face a period of firm growth during the entire baseline period as growing economies throughout the world encourage consumption of livestock products. Ethanol for fuel will also boost corn use and, to some extent, sorghum use. Corn will continue as the feed grain of choice, because of rising yields, especially in the United States. Sorghum, barley, and oats will continue as specialty crops.

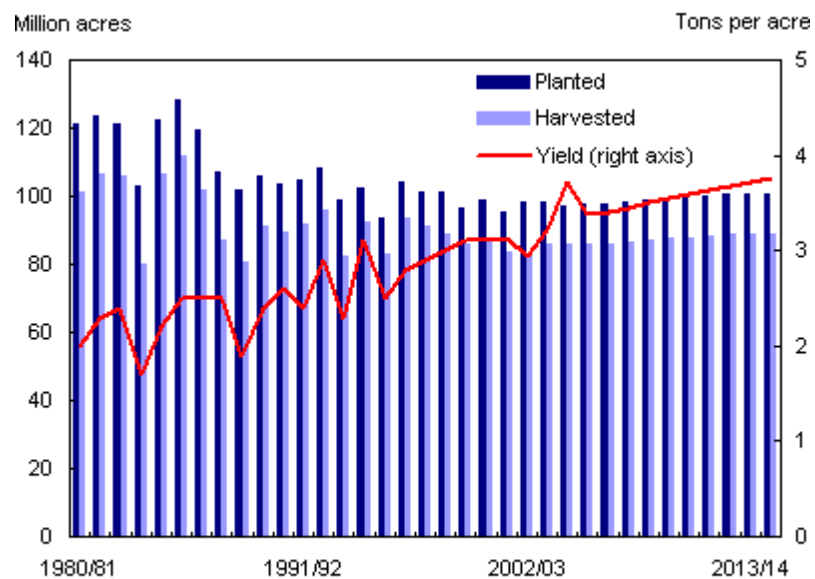
Increased global demand for meat is expected to boost world consumption of feed grains. However, production constraints, especially limited area, will keep many traditional grain-importing countries from expanding production as rapidly as use, boosting global coarse grain trade. Most of the growth is in corn trade, and the U.S. share of corn trade is expected to increase. Global barley trade is also expected to expand, but remain small. Sorghum trade is expected to decline due to reduced imports by Mexico, but later regain initial trade levels.

## Supply

Supply reflects changes in land used for planting and gains in yields of the crops.

**Corn Acres to Increase.** The number of acres planted to corn is expected to total 81 million in 2005 and increase to 84 million by the end of the baseline. Corn plantings are influenced by expected net returns for corn relative to competing crops. Net returns are determined by yields, production costs, and prices. However, the number of acres available for crop plantings is limited. If more water were available for irrigation, additional land could be brought into production but that is not foreseen. As a result, feed grains compete for acres with other crops.

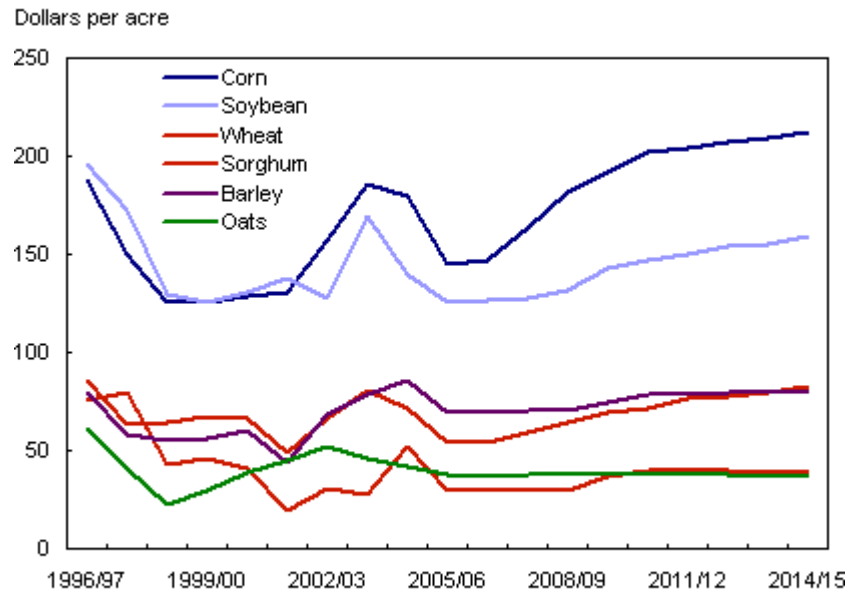
### U.S. feed grain area and yield



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

Among the feed grains, corn has the highest return above variable costs. Soybeans are the major competitor with corn and had returns above corn from 1996/97 through 2001/02. Net returns for soybeans are expected to be below net returns for corn throughout the baseline period, due to lower relative prices caused by increased South American production.

### Net returns for various crops



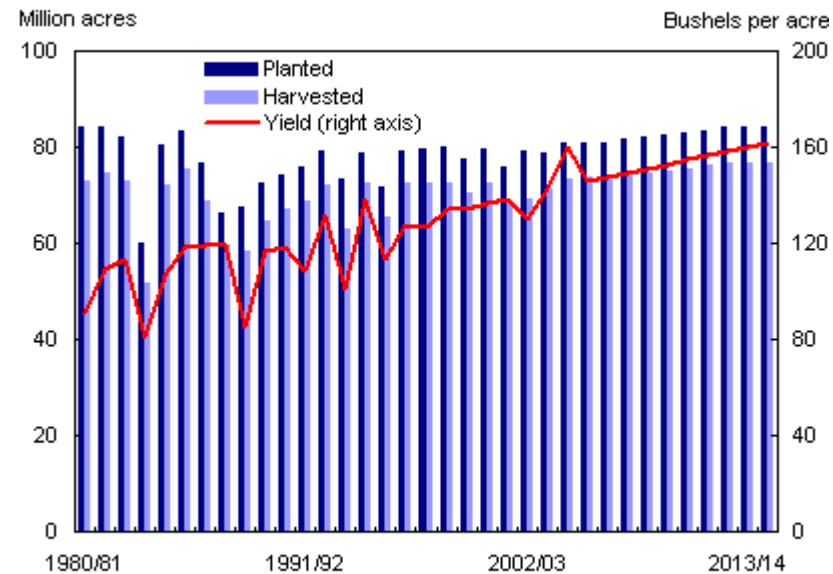
Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

There are benefits to growing crops that may not be reflected in a single year's cost and returns analysis and; thus, expected net returns do not explain all planting decisions. Maintaining rotations is an important objective for most farmers. This provides numerous agronomic benefits and may outweigh decisions based only on price signals. Soybeans and corn work well in rotation because many of the insects that attack one crop do not bother the other crop. Many corn farmers alternate annually between corn and soybeans. Corn is heavily fertilized for large yields and carryover fertilizer benefits soybeans in the following year. Likewise, soybeans roots can host bacteria that convert nitrogen from the air into a form usable by plants if the seed is inoculated prior to planting (a dust containing the nitrogen-fixing bacteria is added to the seed after cleaning). Carryover nitrogen from this process benefits the following corn crop. Before genetically modified, herbicide-tolerant soybeans became available, corn in the rotation was preferable for greater weed control. Now that soybeans can be sprayed to control the weed foxtail, corn may also benefit.

**Corn Yields Continue to Rise.** For the baseline analysis, yields for corn were determined by calculating the trend growth in yields since 1960 (1988 drought year was omitted). As a result of these calculations, corn yields are projected up

1.8 bushels per year over the baseline period. Increases in corn yields have been driven by continued improvements in plant genetics and equipment allowing faster earlier planting and harvesting, along with other advances such as better targeting of fertilizer needs.

### U.S. corn area and yield



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

A similar analysis with 1988 included was performed for barley and oats, but their growth is considerably slower than corn. Barley yields are projected up by 0.6 bushels per year, while oats yields are up 0.4 bushels per year. Sorghum yields, based on a 10-year average, are expected to increase by 0.4 or 0.5 bushels per year.

## Demand

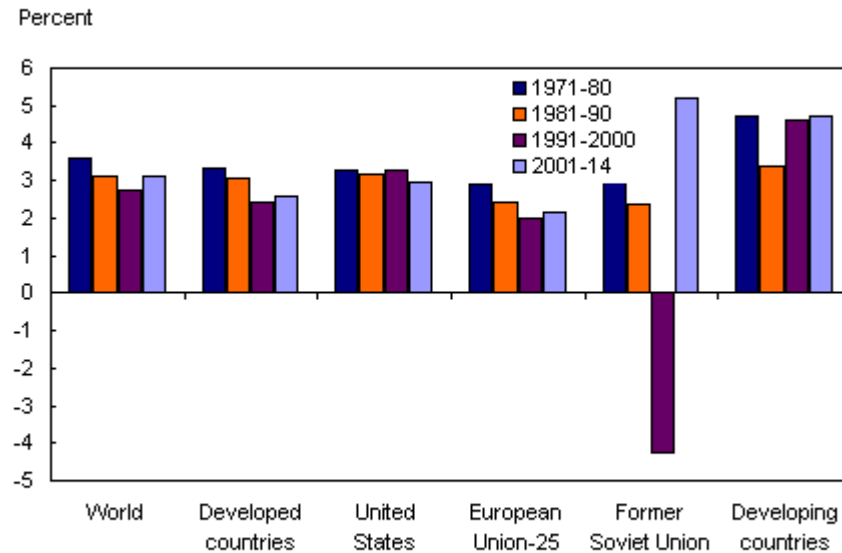
Demand for feed grains is derived from the demand for livestock feed, which is derived from the demand for meat, milk, and eggs.

**Macroeconomic Growth Indirectly Affects Feed Grain Use.** The baseline assumes that growth in U.S. gross domestic product (GDP) moderates in the near term from the rapid growth in 2004 as the economy moves toward a longrun annual growth rate near 3 percent. Ongoing U.S. technological advances associated with computing and telecommunications will provide support for

worldwide economic growth throughout the projection period.

World economic growth is projected to strengthen from the slow growth of 2001-03, averaging over 3 percent through 2014. Most countries of the world move close to longrun sustainable economic growth rates. Relatively high oil prices in 2004 and beyond will constrain Asia and its manufacturing sector, which is far more dependent on energy for GDP growth than more developed economies.

### World gross domestic product (GDP) growth rates, decade averages

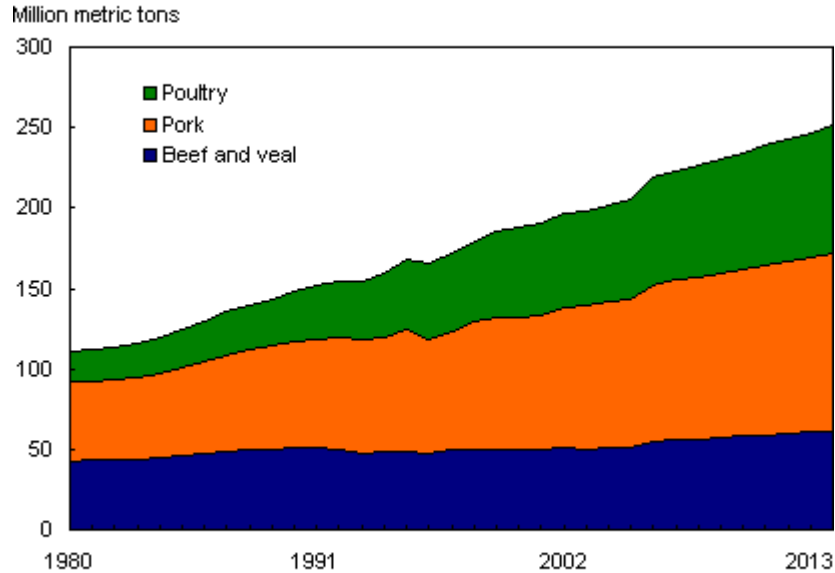


Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

### Definition of country groups

As economies expand, consumers shift to more meat in their diets and this requires more feed grains for meat production. Diets in the United States already have adequate quantities of meat, but an expanding economy will keep meat consumption brisk. Internationally, expanding economies are likely to change diets, especially in developing economies. As a result, the baseline analysis expands world trade in feed grains and increases exports from the United States.

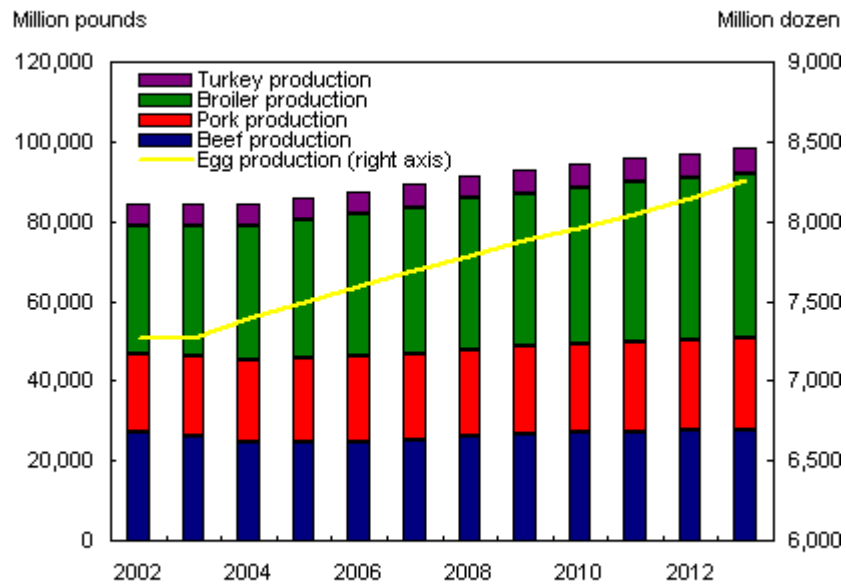
### Estimated global meat production



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

**Livestock Products to Increase, Boosting Feed Grain Use.** Production of U.S. livestock products is expected to increase during the baseline period. U.S. beef production was down in 2004 because of reduced cattle numbers in prior years and small calf crops. In addition, with normal weather, heifers are likely to be held back to rebuild the herds. The combination of a small calf crop and larger numbers of replacement heifers will slow beef production increases in 2006. Beginning in 2007, beef production will continue increasing through the end of the baseline period. As increased numbers of cattle go on feed, more feed grains will be needed.

### Domestic livestock and poultry production



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

Pork production in 2005 is expected to be up 1 percent from 2004, and then continue increasing through 2014. The greatest gains are forecast for 2006 at 1.8 percent per year and 2008 at 1.5 percent. Production may slow during the remainder of the baseline period, but still rise nearly 1 percent per year. The increase in hog numbers will necessitate more feed grains, primarily corn.

Broiler production is projected to increase throughout the baseline period. With beef production down in 2004, broiler production was up 4.2 percent. But growth will slow to about 3 percent per year during the baseline. Thus, feed needs for the broiler industry are expected to grow over the period.

Feed needs for turkey and egg producers are also expected to increase during the baseline period. Projected turkey production is expected to be up about 2 percent annually during 2005-14. Egg production is projected to increase about 1 percent per year during the period.

Milk production is projected to increase slowly, around 2 percent annually through 2007/08, and then decline to near 1 percent growth in the out years. Dairy cow numbers are expected to continue their long-term decline throughout the baseline period. Production gains are the result of increased production per cow.



As a result, feed needs are likely to increase.

**Ethanol Use Continues to Grow.** Corn used for producing fuel alcohol has grown sharply since the early 1980s. As a result, fuel alcohol has become the largest component within the food, seed, and industrial (FSI) use category. The volume of total FSI has overtaken even corn exports in recent years. Corn's use in fuel alcohol production depends on the interaction of government incentives and policies, technology development, corn prices, prices of coproducts from ethanol production, and prices of energy substitutes.

Ethanol production expanded very rapidly until marketing year 1995/96 (September-August), when there was a major contraction due to tight corn supplies and record high corn prices. Since then, ethanol output has rebounded, especially since methyl tertiary butyl ether (MTBE), a competing oxygenate produced from methyl alcohol, was banned in many States and policies have encouraged ethanol use.

Policies are very important for the expansion of ethanol production. A federal tax credit for ethanol blending, currently 51 cents per gallon, is assumed to continue. However, the biggest factor underlying the recent expansion has been the adoption of ethanol by California, the Nation's largest gasoline market, after it prohibited the use of MTBE. The need to ramp up production to meet mandated use has boosted production, especially since New York and Connecticut have also banned MTBE. Ethanol is the principal replacement oxygenate where reformulated gasoline is used, requiring 2-percent oxygen by weight.

Policy-influenced market conditions are also critical determinants of ethanol production. More than half of all fuel ethanol is blended into conventional gasoline as a fuel or octane enhancer. Prices of ethanol relative to gasoline prices are a key component for determining how much ethanol is blended. The remaining ethanol is used for blending into reformulated gasoline, which will be important in California, New York, and Connecticut. It is also used in oxygenated gasoline for the winter carbon monoxide program. (The program requires the use of oxygenated gasoline for designated winter months. The intent of the oxygenate is to offset the increased carbon dioxide levels emitted from gasoline engines due to hard starting and lengthy warm-up periods in cold weather).

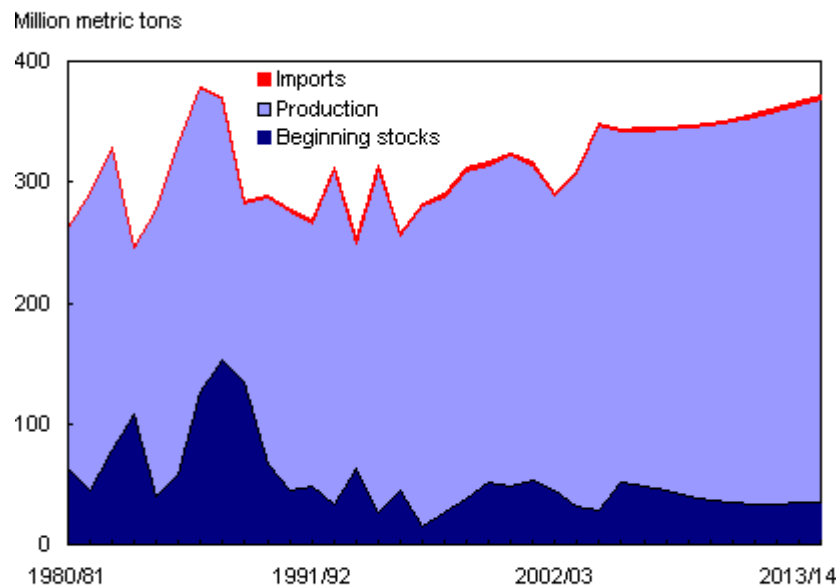
While use of oxygenates largely results from mandated clean air requirements, fuel producers can choose among competing oxygenates based on their relative prices. Some States offer incentives that also influence demand for ethanol. For instance, Illinois has a sales tax exemption for ethanol, while Minnesota has mandated a year-round minimum oxygen content requirement for all gasoline sold.

## Baseline Projections for U.S. Feed Grains Supply and Use

U.S. feed grain supplies and use are expected to increase over the baseline period, after a drop in 2005/06 from 2004/05 (because the trend yields used in the analysis are lower than the actual yields for 2004).

**Most Production Gains Expected from Productivity.** Feed grain production increases throughout the projection period, as yield growth accounts for most of the expanded output. Corn is expected to gain in share of total feed grain production and use. Corn area is projected to experience moderate growth over the baseline period and oats may remain unchanged. Sorghum and barley plantings are expected to decline slowly. Net returns for all four feed grains decline sharply the first year of the baseline because the trend yields used in the analysis are lower than the actual yields for 2004. Net returns for oats are nearly constant during the projection period, while net returns for corn, sorghum, and barley increase.

### U.S. feed grain supply

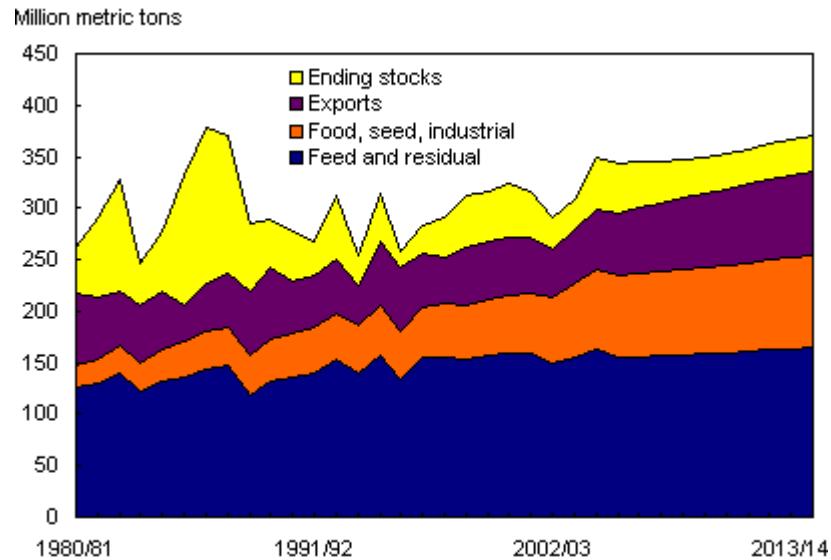


Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

After the first year of the baseline period, total feed grain use is projected to set new records. By 2014, exports are expected to grow about 45 percent from the

58 million metric tons in 2004/05, a robust growth rate relative to the past two decades. By 2009, exports are projected to surpass the old record set in 1979. Improved growth in global imports is expected, and U.S. feed grain exports are expected to encounter only moderately higher competition throughout the projection period.

### U.S. feed grain utilization



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

U.S. ending stocks of feed grains are projected to decline slowly until 2011/12 then increase and remain between 34 and 35 million metric tons. These ending stocks are slightly below the average ending stocks in the 1990s of 41 million metric tons. Productivity is projected to account for most of production growth, with the remainder coming from increased plantings.

**Corn Supply and Use to Grow.** Corn area is expected to grow and yields increase, resulting in new record corn production. Use will likely also set records as livestock herds grow, raising feed needs, and industrial uses for corn expand. China becomes a net importer in 2007/08 (see [Baseline projections for world feed grains trade](#)), contributing to projected exports of U.S. corn increasing throughout the baseline.

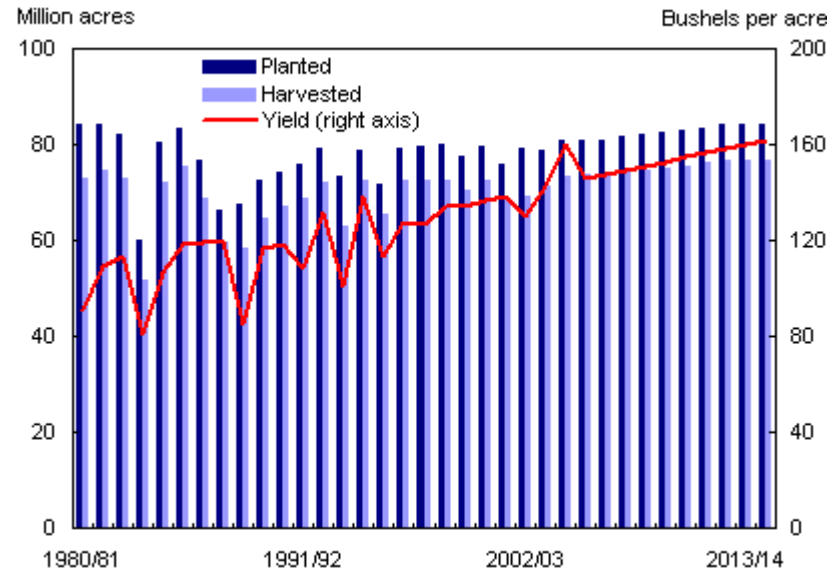
Corn prices in 2005/06 are expected to be higher than in 2004/05, reflecting supply growing less than total use. At the onset of the baseline, domestic corn

use is strong, and continues expanding throughout the period. U.S. corn exports are also expected to grow. The U.S. share of global corn trade is expected to increase, mostly because of reduced exports and increased imports by China. Global corn trade is expected to grow, given rising global meat demand.

Planted area for corn is projected to remain relatively large and grow slowly over the baseline period, as use strengthens and prices improve. Corn competes mostly with soybeans for land and is used extensively in rotations with soybeans. Corn area grows relative to soybean area, as relative net returns are expected to favor corn throughout most of the baseline.

Gains in corn yields are expected to continue over the entire baseline period, facilitated by genetic improvements. Corn production is projected to increase, setting new records.

### U.S. corn area and yield



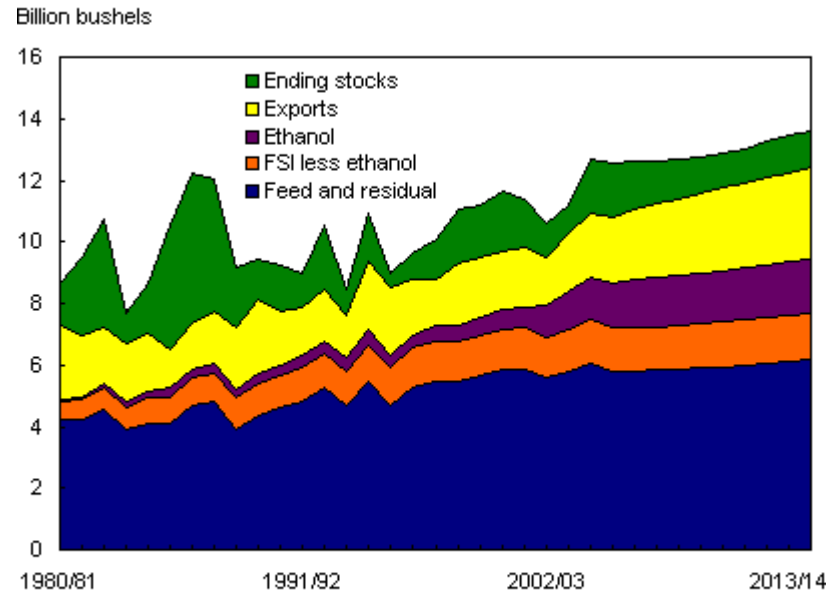
Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

**Increasing Meat Production Boosts Feed and Residual Use.** Feed and residual use is expected to decline in 2005/06, the initial year, but grow throughout the remainder of the projection period. Increasing U.S. meat production and associated livestock (measured by grain-consuming animal units) account for the rising use of grain.

Despite its growth, direct feed use of corn is not as strong as it would be without coproducts from ethanol production. Ethanol wet mills produce corn gluten feed, corn gluten meal, and corn oil as coproducts, while dry mills produce distiller's dried grains (DDG). The baseline assumes that each 56-pound bushel of corn that goes into dry-mill ethanol production results in 17.5 pounds of DDG as a coproduct. The [protein content of DDG for beef cattle](#) is about 23 percent, compared to 48 percent for soybean meal and about 10 percent for corn. The energy content of DDG falls between that of corn and soybean meal. Thus, the baseline assumes that the DDG coproduct of dry-mill ethanol production substitutes for about a 50-50 split of corn and soybean meal in feed rations, or about 8.75 pounds each of corn and soybean meal for each bushel of corn used for ethanol production.

**Ethanol Production Keeps Corn use High.** Food, seed, and industrial (FSI) use of corn is anticipated to increase throughout the baseline period, beginning at a record level. Major growth is expected in ethanol use because many States are banning MTBE and ethanol is its principal replacement. Greater corn use is projected in the baseline as the ethanol industry expands production. Gains for high fructose corn syrup (HFCS) and most other food and industrial components are projected to be smaller than in the previous decade. Food and starch, other segments of FSI use, are mature markets and projected gains largely reflect population growth.

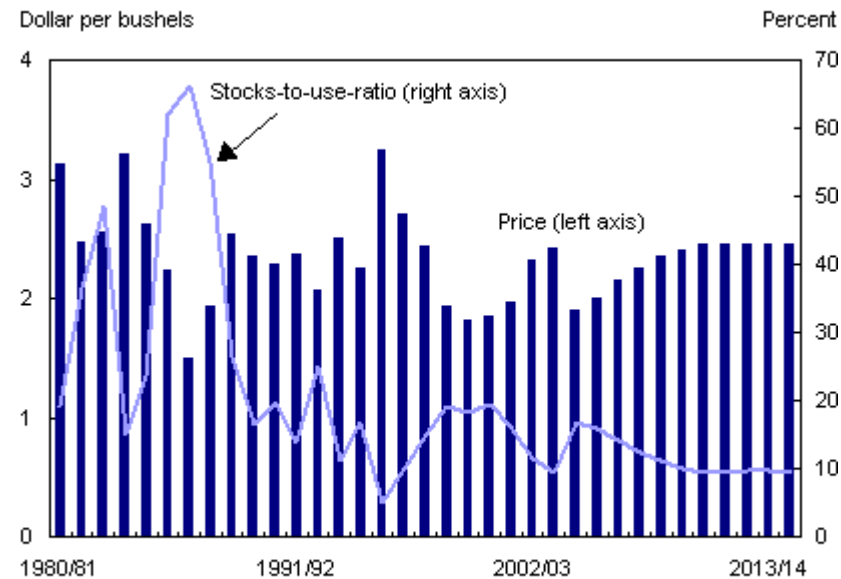
Projected exports demonstrate growth compared with the 1980s and 1990s, but remain below the record established in 1979/80 until the middle of the forecast period. World corn imports grow because of increased meat production.

**U.S. corn utilization**

Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

Ending stocks of corn are expected to decline to around 1.1 billion bushels toward the later part of the baseline period, but then increase. Prices strengthen from lows in the early 2000s to \$2.45 per bushel toward the end of the projection period, as the stocks-to-use ratio declines slightly.

### U.S. corn price and stocks-to-use ratio



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

**Sorghum Supply to Remain about Steady.** Growth in [sorghum](#) production is expected to equal use, resulting in nearly constant ending stocks. Acres planted are expected to decline only slightly, but yields increase. Feed and residual use will vary depending upon supply, but food, seed, and industrial use (primarily ethanol production) will increase.

Sorghum production is projected to grow to 450 million bushels by 2014. This reflects a slight decline in plantings but trend yield growth of 0.4 to 0.5 bushels per year. Despite the projected yield growth during the baseline period, yields are not expected to exceed 1994's record of 72.7 bushels per acre.

Sorghum exports decline during the baseline, especially in 2006-08 when reduced tariffs on corn trade with Mexico lead to higher U.S. corn exports and lower sorghum shipments. With reduced U.S. sorghum exports, increased feed and residual use is projected. Food, seed, and industrial use rises slowly in the baseline, remaining record high due to growth in ethanol production.

**Barley Supplies Increase Modestly.** Rising yields are expected to modestly increase [barley](#) production, reaching 255 million bushels by 2014. Planted acreage declines slightly over the period, as barley's net returns cannot compete

for more area. Yield per acre is expected to increase 0.6 bushels over the period, in line with trend increases.

Food, seed, and industrial use was held steady over the baseline, mainly because beer production in the United States is expected to level off. Barley feed and residual use increases slightly during the baseline period in line with production. Barley exports are projected to be 15 million bushels per year, as shipments of feed barley to the Middle East continue. Imports are expected to remain unchanged at 25 million bushels, because of malting barley imports from Canada. The average barley price is projected to rise through the baseline, reaching \$2.65 per bushel by the end of the period.

**Oats Plantings Unchanged.** Supplies grow modestly as increased yields and oat imports, principally from Canada, supplement domestic [oats](#) production. Food, seed, and industrial use is expected to remain unchanged, with some rise in feed and residual use, keeping ending stocks relatively constant.

The declining long-term trend in oat acreage is projected to stabilize. With oat plantings expected to remain constant during the baseline period, slow growth in yields results in a 5 million bushel increase in production by the end of the period. The crop will remain important in some rotations and as a cover crop. There is also some modest growth in imports. Supplies drop in the beginning year of the baseline because plantings and yields decline. Supplies grow in subsequent years of the baseline, but do not reach the levels of 2004/05. Total use starts at 186 million bushels, increasing to 196 million due to higher feed use. Imports rise from 85 million bushels to 95 million, or 36-37 percent of supply, making up the difference between production and use. Feed and residual use ranges from 110 million bushels to 120 million. Oat prices increase over the baseline period, and imports supplement domestic supplies.

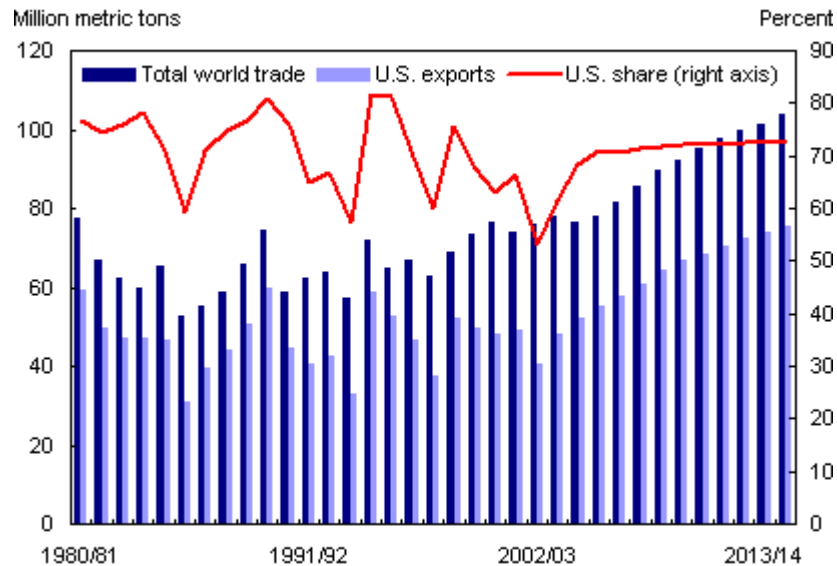
## Baseline Projections for World Feed Grains Trade

The USDA baseline also provides projections for global trends in feed grain supply, use, and trade.

**Expanding Consumption to Boost Corn Trade.** Increased global demand for meat is expected to boost world consumption of [feed grains](#). However, production constraints, especially limited area, will keep many traditional importing countries from expanding production as rapidly as use, boosting global trade from 102 million metric tons in 2005/06 to 131 million in 2014/15. Most of the growth is in [corn trade](#), up from 78 million metric tons in 2005/06 to 104 in 2014/15. The U.S. share of corn trade is expected to increase from 70.9 percent during 2005/06 to 72.7 percent by the end of the projection period.



### World and U.S. corn trade



Source: *USDA Agricultural Baseline Projections to 2014*, February 2005.  
Economic Research Service, USDA.

As recently as 2002/03, China was the second largest corn exporter. China, however, is expected to limit exports and gradually increase imports of corn, becoming a net importer by 2007/08. Corn area expansion in Argentina is expected to be limited by profitable returns for soybeans. Area expansion is also expected to be limited in other exporting countries such as South Africa and Thailand. As Eastern European countries like Hungary join the European Union (EU), less corn is exported outside of Europe. However, Brazil is expected to remain a significant net exporter of corn because of attractive world prices and niche marketing.

China is key to the future of global corn trade. In recent years, China has maintained corn exports, while reducing stocks when production fell below domestic use. Chinese stocks are now thought to be reduced to levels that will limit future stock declines because they would likely boost internal prices. Meat demand in China is expected to rise because of strong income growth. Rapid gains in meat production are expected to increase corn feed use. While corn yield growth is projected to rise less than 1 percent per year, area increases will be limited by higher returns from other land uses. So by 2007, China becomes a net importer of corn. Nonetheless, northeast China is expected to remain a surplus corn producing region and, because it is so close to South Korea—one of the

world's largest corn importers—China is expected to continue exporting corn. However, southern China is further away, and is expected to be an increasingly corn deficit region, boosting imports during the baseline period.

Growth in global corn imports over the baseline period is not limited to China. Most corn importing countries are expected to increase imports as meat production rises because of factors that limit the growth in corn production. The largest increase in corn imports is expected for Mexico, where a switch from sorghum to corn is expected on top of strong growth in meat production. Imports by the rest of Latin America are expected to grow only modestly, at about the pace of population growth. With stronger economic growth, Egypt is expected to lead the growth in corn imports by North Africa and the Middle East. With limited barley area, and increasing barley exports, Canada is expected to increase corn imports to support meat production increases. Russia and other former Soviet Union countries increase corn imports faster than Ukraine increases exports, making the region a growing net importer of corn. However, some markets, like Japan, are expected to reduce imports due to slow growth in meat consumption combined with higher meat imports.

**Barley Trade to Expand.** Global [barley trade](#) is expected to expand slowly, from 15 million metric tons in 2005/06 to over 17 million by the end of the baseline. Demand for feed barley is expected to grow in North Africa and the Middle East, where production increases are limited by the climate, but imports by Saudi Arabia are expected to be nearly flat. Imports of barley by Saudi Arabia depend on rainfall and grazing for sheep and camels. China leads import growth in barley for malting. EU stocks are expected to limit the pressure to subsidize EU barley exports, so EU barley exports are expected to remain near 3 million metric tons throughout the baseline. Barley exports by Australia, Canada, and Ukraine are expected to increase. U.S. barley trade is expected to remain small.

**Sorghum Trade to Decline.** [Sorghum trade](#) is expected to decline from nearly 7 million metric tons in 2005/06 to less than 6 million in 2008/09 because of reduced imports by Mexico, but then show some recovery by the end of the baseline. Mexico's current system of variable rate quotas for corn with "cupos" for over quota imports tends to discourage corn imports and boost sorghum imports that do not have quotas. However, under the North American Free Trade Agreement, Mexican corn tariffs are phased down and disappear by 2008. As corn tariffs are reduced and then eliminated, Mexican feed compounders are expected to shift to corn, away from sorghum. Japan is also expected to reduce sorghum imports slightly as feed grain imports decline.

Other coarse grain trade is expected to grow very slowly over the baseline period, with a small increase in oats trade nearly offset by reduced rye trade. EU policy is expected to maintain oat production and exports, but a drop in EU rye production

(due to reforms of the EU's Common Agricultural Policy that ended rye intervention prices) and exports is expected. Canada will remain the main supplier of imported oats to the U.S. market.

## **Industry Prospects Are Good**

Yields per acre for U.S. feed grains will continue to increase, and corn yields will grow at the fastest rate. Rising corn yields help boost net returns, keeping planted area up. Slower yield growth for barley and other feed grains makes them less attractive to producers, leading to a slight decline or no change in acres planted over the period. Corn production is projected up 16 percent over the 2005-14 period, sorghum is up 3 percent, barley up 6 percent, and oats are up 5 percent.

Strong use both domestically and worldwide keeps feed grain prices above U.S. loan rates during most of the baseline, reducing government farm program costs. Use of corn for corn sweeteners is expected to grow at the rate of population increase. Use of corn to produce ethanol for fuel will continue to climb. Feed and residual use will also expand over the period as livestock and poultry production continue to increase.

Increased global demand for meat is expected to boost world consumption of feed grains. Global trade in feed grains is expected to rise because many traditional importing countries will not be able to increase production as much as the gains in consumption. Most of the growth in trade is in corn and the U.S. share of the market is expected to increase.

**For more information, contact:** [Allen Baker](#) or [Ed Allen](#)

**Web administration:** [webadmin@ers.usda.gov](mailto:webadmin@ers.usda.gov)

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