USDA
United States Department of Agriculture

FTS-347-01

July 2011

Outlook

A Report from the Economic Research Service

www.ers.usda.gov

# Characteristics of Conventional and Organic Apple Production in the United States

**Edward Slattery, Michael Livingston, Catherine Greene, and Karen Klonsky**

## Abstract

While U.S. acreage and production of apples has declined in recent years, consumer demand has spurred a fast-growing organic apple sector. Apples managed under certified organic farming systems now account for about 6 percent of total U.S. apple acreage. In 2007, USDA conducted the first comprehensive survey of the production and marketing practices used by organic and conventional apple growers in the United States as part of the Agricultural Resource Management Survey (ARMS). In this report, we use data from ARMS and other sources to examine trends in the U.S. apple sector and compare production and marketing characteristics under organic and conventional farming systems. According to ARMS data, conventional and organic apple production systems shared many similarities in 2007, including the predominance of dwarf and semi-dwarf trees, tree density, and a focus on fresh-market apples. These systems do differ in the way pests and nutrients are managed, and a higher share of organic production comes from new varieties like Gala and Fuji. While conventional apple yields were higher than organic yields in 2007, organic apples commanded a price premium at every level—farm-gate, wholesale and retail—of the supply chain.

**Keywords:** Fresh apples, processed apples, production practices, pest management, pesticides, apple prices, organic price premiums

## Acknowledgments

The authors gratefully acknowledge David Granatstein (Washington State University) for his insights and suggestions as we developed this report. We thank Agnes Perez, Pat Sullivan, Linda Calvin, and Molly Garber (USDA, Economic Research Service); and Sarah Johnston (New York Department of Agriculture) for their contributions. The report was cleared by John Love at the World Agriculture Outlook Board. The authors also thank Angela Anderson for editorial assistance and Cynthia A. Ray for layout and design.

**Contents**



Approved by USDA's World Agricultural Outlook Board

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# Introduction

According to USDA's most recent Census of Agriculture, farms and ranches with some apple production were reported in all 50 States. The number of farms producing apples, however, has continued to slide over the last decade, falling from nearly 34,000 in the late 1990s to 25,600 farms in 2007. The number of acres with apple trees also fell over the last decade, and apple production continues to be concentrated in Washington State, New York, Michigan, and a few other States. About 40 percent of U.S. apple production is used to make juice, applesauce, and other processed products. Apple producers have faced greater import competition since the late 1990s, particularly for apple juice.

Despite the drop in production over the last decade, the U.S. apple sector has seen fast-growing demand for new varieties of apples and for organically produced apples that garner price premiums. Organic apples are one of the top three fresh fruits purchased by consumers of organic foods, and fresh produce is the largest category of organic food sales. Organic sales growth continued to outpace growth in overall food sales even during the recent economic downturn, and organic produce continues to show double-digit growth (*Nutrition Business Journal*, 2010).

While consumers buy organic apples and other products for a variety of reasons, health is often cited as the primary reason (Organic Trade Association, 2009). The U.S. apple industry had its first brush with consumer health concerns about chemical use in food production in February 1989, when media coverage focused on the use of the growth regulator Alar.[1] Apple prices declined sharply after the media coverage and revenue fell by an estimated $140 million that season (Buxton, 1989). The U.S. Environmental Protection Agency (EPA) proposed to cancel all food uses of Alar in May 1989 after determining that long-term exposure could pose significant health risks, and the manufacturer voluntarily halted Alar sales and distribution for food uses the following month (EPA, 1989). U.S. apple prices and revenue rebounded quickly the following year, and the United States continues to tighten pesticide regulations. The 2008-09 annual report of the President's Cancer Panel recommended that individuals reduce their environmental cancer risk by choosing, "to the extent possible, food grown without pesticides or chemical fertilizers and washing conventionally grown produce to remove residues." (U.S. Department of Health and Human Services, National Institutes of Health, 2010, p. 112).

Apple producers that adopt organic farming systems do so for a variety of reasons. Forty-five percent of respondents to USDA's 2007 Agricultural Resource Management Survey (ARMS) of organic apple producers indicated that they chose organic production systems primarily to increase farm income. Another 23 percent of the respondents indicated that they grow organic products primarily to protect the health of their family and the community, and 19 percent said they wanted to adopt more environmentally friendly practices.

[1]Alar is the trade name of a chemical plant growth regulator, Daminozide, that was sprayed on fruit to make harvest easier and to enhance color.

In this report, we use data from ARMS and other sources to examine trends in the U.S. apple sector and compare production and marketing characteristics under organic and conventional farming systems (see box, "USDA Agricultural Resource Management Survey"). We also examine policy changes that affect production practices and examine market and policy initiatives that may allow U.S. organic and conventional apple production to be more competitive with other types of fruits produced domestically or imported.

## USDA Agricultural Resource Management Survey

The Agricultural Resource Management Survey (ARMS) is an annual survey of farm and ranch operators administered by USDA's National Agricultural Statistics Service (NASS) and Economic Research Service (ERS). Survey data are collected on field-level production practices, farm business accounts, and farm households. The data provide insights on many facets of the agricultural sector, including the organization and performance of farms, the income and well-being of farm households, and the economics of production practices used across commodity enterprises.

ARMS uses a three-phase, two-frame, stratified, probability-weighted sampling design that involves a series of interviews with farmers about their farm business and household characteristics. In 2007, apples were the targeted commodity in ARMS and a large targeted oversample of certified organic producers was included to produce statistically reliable estimates on this segment of the apple sector. Phase 1 of ARMS is conducted during the summer of the reference year, during which farmers in the sample are screened to verify their operating status and to determine which commodities they produce.

Data collection begins with Phase 2, which is conducted in the fall and winter of the reference year. Randomly selected farmers passing the first phase are interviewed to collect data on their production practices and input use on a randomly selected field. In 2007, 1,060 usable Phase 2 questionnaires were completed by apple producers in the surveyed States. Phase 3 was conducted in the spring of the year following the reference year. All Phase 2 respondents are asked to complete the Phase 3 survey, which requests information on farm-level costs and returns for the reference year. In 2007, 953 usable Phase 3 questionnaires were completed by apple producers; 782 of those producers provided usable data from the Phase 2 questionnaire.

USDA uses two sampling frames to select farms—a list frame and an area frame. The list frame includes most large farms and farms expected to produce specific commodities and accounts for 100 percent of Phase 2 responses and 95 percent of Phase 3 responses. The area frame captures farms not included on the list frame and consists of randomly selected agricultural land segments.

The farm population is stratified at the State level by revenue in the list frame and by land use or crop type in the area frame. Farms in different strata are sampled with a different probability of selection. For this reason, when using these data to estimate aggregate totals, means, and standard errors, observations must be weighted to account for the probability of farm selection, the extent of aggregation, and the calibration scheme. Calibration refers to modifying weights so that, for example, the weighted sums of apple-bearing acres reported by the survey respondents in different States equals the official USDA estimate for those States during the reference year, obtained from other NASS surveys. USDA provides more information about ARMS and access to custom estimates through an interactive online interface, see www.ers.usda.gov/Briefing/ARMS/.

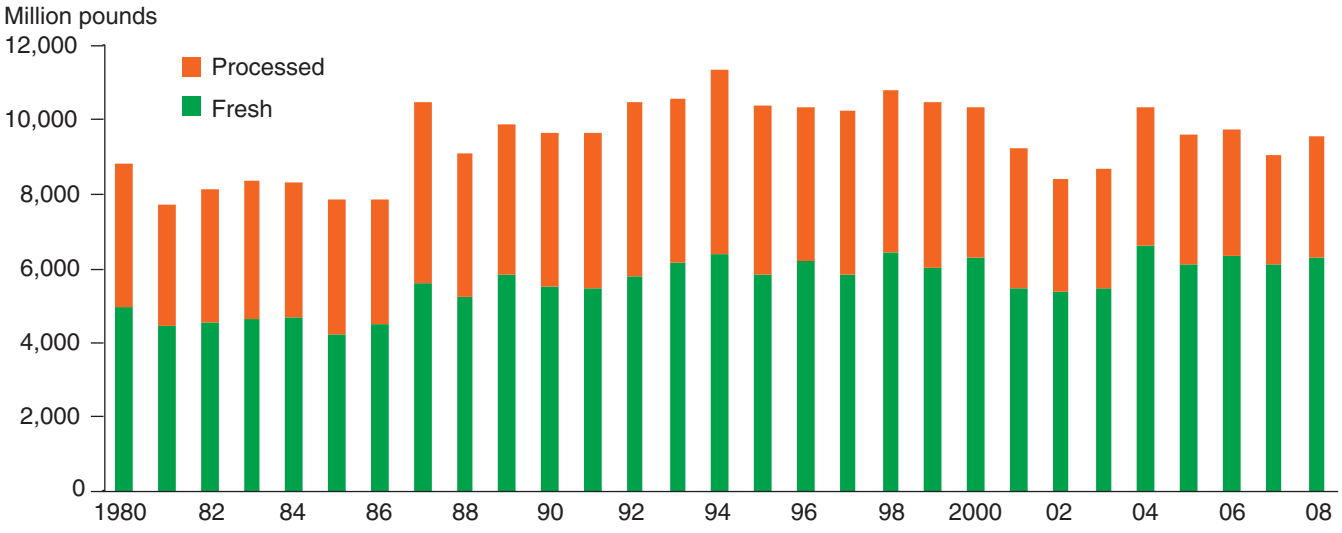
# U.S. Apple Acreage and Production Declining

U.S. crop acreage devoted to apple production has declined nearly 25 percent since the peak in 1994. Most of this contraction has been in production for the processing sector—production of apples for juice and other processing markets is down by a third over the period (fig. 1). Import competition for the U.S. juice market—particularly from China—has intensified since the late 1990s, and the import share of the U.S. juice supply increased from 60 percent to over 80 percent during this period.

Washington State currently produces over half the Nation's domestically grown apples and has been the leading apple-growing State since the early 1920s (Schotzko and Granatstein, 2005). In 2009, Washington State produced 5.4 billion pounds of apples, and New York and Michigan produced over 1 billion pounds each (fig. 2). Apple production has been somewhat stable in Washington State, New York, and Michigan since the 1990s, but production in many other States has declined.

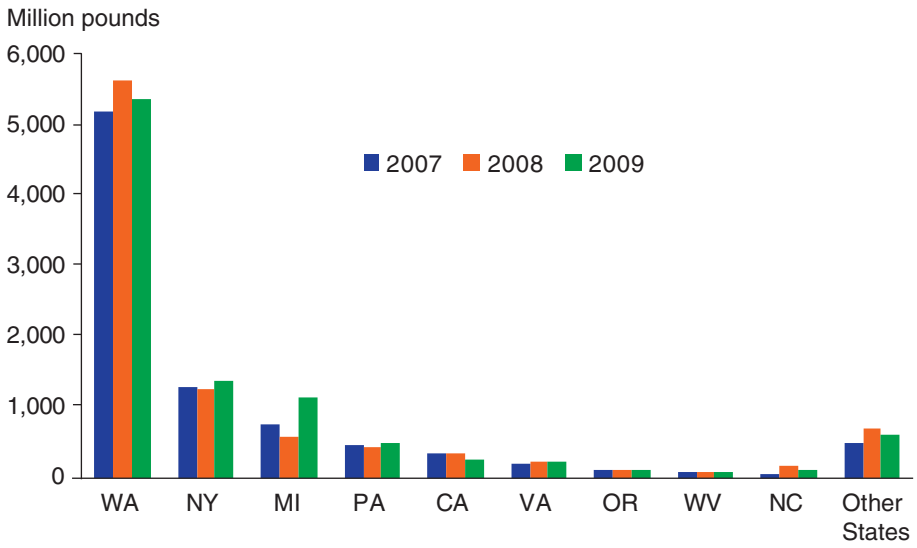
U.S. fresh-market apple consumption peaked at approximately 21 pounds per person in 1990. Per capita consumption has fallen steadily since then to about 16 pounds per person. U.S. consumption of apple juice and cider has trended up during this period—from 1.5 gallons per person during the 1991/92 marketing year to 2.1 gallons per capita in 2009/10—but imported products have met the increased demand in this market. Industry analysts point out that produce consumption is strong among certain fast-growing segments of the U.S. population—Hispanics and aging baby boomers—and overall sales have been growing. Overall per capita consumption of fresh fruits, however, has remained fairly flat in the United States for several decades, and apples must now compete for market share with an increasingly wide variety of fresh fruits that are available year round.

Figure 1
**U.S. apple production peaked in the mid-1990s**




Source: USDA, National Agricultural Statistics Service, *Noncitrus Fruits and Nuts Summary*, various issues.

Figure 2
**U.S. apple production, by State**




Source: USDA, National Agricultural Statistics Service.

One segment of the U.S. apple sector, however, has seen an increase in demand. Certified organic acreage for apple production doubled between 1997 and 2008 to approximately 18,000 acres—5 percent of the U.S. acreage devoted to apple production (USDA, ERS, 2010). Industry analysts estimate that U.S. certified organic apple acreage exceeded 21,000 acres in 2009 (Kirby and Granatstein, 2010), accounting for over 6 percent of total U.S. apple acres.

Washington State dominates U.S. organic (and conventional) apple production. Washington State apple producers managed approximately 13,000 acres under certified organic production systems in 2008, followed by California producers with about 3,000 acres and Arizona producers with about 900 acres (USDA, NASS, 2010). The other top organic apple-producing States included New York, Colorado, Maine, and Michigan, with less than 500 acres each. In general, Eastern States tend to lag behind Western States in organic apple production.

Washington State's arid climate, which benefits conventional apple production, is even more advantageous for organic apple production. Synthetic pesticides are not used in organic apple production, and organic pest management is much more challenging in the humid climates of Eastern States where pests and disease are more prevalent. Also, research centers, companies, and individuals in Washington State have been conducting intensive research on organic apple production systems over the past decade that has resulted in substantial improvements in the taste and appearance of organic apples (Black, 2007). Improvements in organic pest management, particularly for coddling moth, have been key in improving organic apple quality, although many challenges remain (Granetstein, 2010).

# Farm and Orchard Characteristics, 2007

In 2007, ARMS included a targeted survey of apple producers, including an oversample of organic apple producers, to gather data on farm production practices and economic characteristics (see box, "USDA Agricultural Resource Management Survey"). Survey responses were collected from 1,060 organic and conventional apple producers in seven States—California, Michigan, New York, North Carolina, Oregon, Pennsylvania, and Washington. Producers in these States accounted for 81 percent of U.S. harvested apple acres and 87 percent of U.S. apple production in 2007.

Most of the apple production in these States was managed under conventional systems and most was sold into fresh markets. Conventionally produced apples accounted for 78 percent of the seven-State total in 2007, and fresh organic apples accounted for 5 percent of the total (table 1). Among all fresh-market apples produced in these States in 2007, Washington State accounted for almost 70 percent of conventional production and an even higher share—over 90 percent—of organic production.

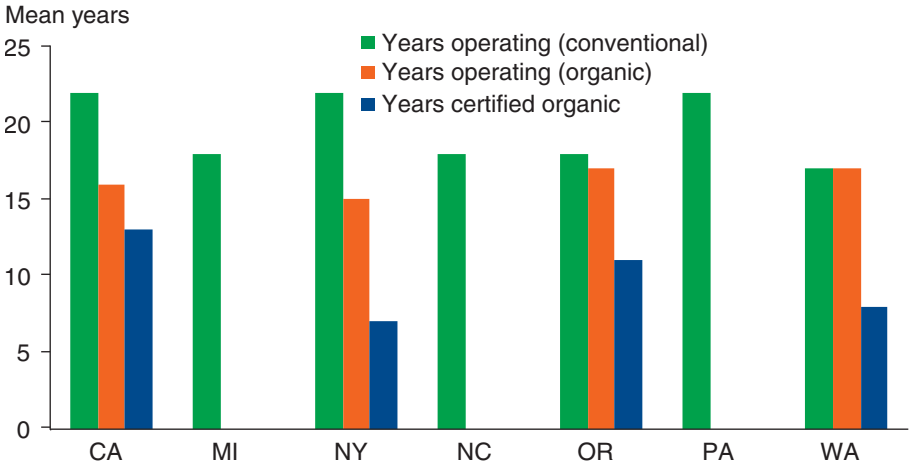
U.S. conventional apple producers have been operating for 19 years, on average. Tenure is a little longer than average in California, New York, and Pennsylvania but is less than average in the other surveyed States (fig. 3). Organic apple producers have been operating a farm for an average of 17 years and have been certified as organic for an average of 9 years—longer in California and Oregon and less than the average in Washington State and New York. Part of the difference between the average years of experience and the average years of certified organic acres reflects the 3-year transition

Table 1
**U.S. apple production and market share in surveyed States, 2007**

| | Total production | Conventional systems | | Organic systems | |
|---|---|---|---|---|---|
| | | Fresh-market | Processing | Fresh-market | Processing |
| | *Tons* | *Tons* | | | |
| Surveyed States[1] | 4,081,482 | 3,173,404 | 706,093 | 191,330 | 10,655 |
| | | *Percent of total seven-State production* | | | |
| California | 232,167 | 4 | 12 | 8 | 68 |
| Michigan | 389,162 | 8 | 21 | <1 | 14 |
| New York | 664,404 | 14 | 31 | <1 | 9 |
| North Carolina | 33,768 | 0 | 3 | ** | ** |
| Oregon | 52,159 | 2 | <1 | <1 | 3 |
| Pennsylvania | 273,408 | 4 | 23 | ** | ** |
| Washington State | 2,436,414 | 69 | 11 | 91 | 6 |

[1]Surveyed States accounted for over 87 percent of U.S. apple production.
Totals do not add to 100 due to rounding.
**=North Carolina and Pennsylvania had no respondents with certified organic acres.
Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service; the 2007 Census of Agriculture; and the 2008 USDA Organic Production Survey.

Figure 3
**U.S. apple producers, by State and operating status**




Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

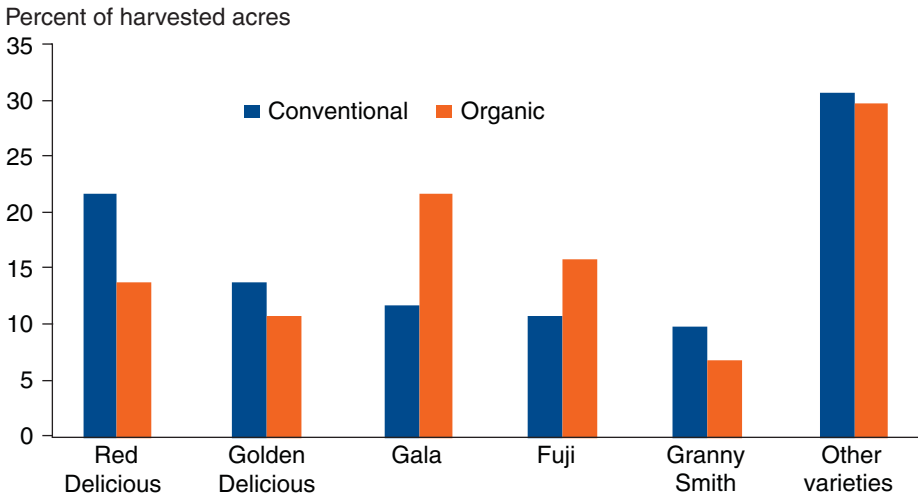
period that most organic growers must undergo, and it also reflects the long tenure of many growers as conventional growers prior to transition. While most organic producers—63 percent—operated orchards for 5 years or less before being certified organic, a few (13 percent) operated orchards conventionally for more than two decades prior to certification.

Unlike organic producers in Europe, U.S. organic producers are allowed to run mixed operations, and many conventional producers transition slowly to all-organic production. In 2007, most of the certified organic apple production in the surveyed States took place in orchards that were exclusively organic. Only 16 percent of the organic acreage was managed by respondents with conventional apple production as well. These mixed operations tended to have more acreage than conventional operations, while organic-only operations were the smallest.

Slightly over half the conventional and organic apple producers surveyed in 2007 grew only apples. About 36 percent of apple growers grew one or two additional fruit or nut crops. Peaches were the most common other crop grown by apple producers in Michigan, North Carolina, New York, and Pennsylvania. Pears were the most common other crop in Oregon—apple producers there have more pear than apple acres. Grapes were the most common other crop in Washington State and nuts were the most common in California.

**Apple Varieties, Tree Size, and Density.** Although Red Delicious market share has declined in recent decades, it is still the top variety grown in the United States. In 2007, the top five apple varieties—Red Delicious, Golden Delicious, Gala, Fuji, and Granny Smith—were the same in conventional and organic production, although the order differed between the two production systems. These five varieties accounted for over two-thirds of conventional and organic apple production in the surveyed States (fig. 4). Red Delicious, Gala, and Fuji are primarily fresh-market apples, while Golden Delicious and

Figure 4
**Top U.S. apple varieties, by type, 2007**




Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

Granny Smith are "dual-purpose" apples that can be used in either fresh or processing markets.

The top three varieties used by organic producers—Gala, Fuji, and Red Delicious—are all fresh-market apples, reflecting this sector's concentration in fresh-market production. Organic apples are produced mostly for the fresh market for several reasons:

- Apple processing is concentrated in the Eastern States, which produce a smaller share of organic apples;
- Processing markets are still developing for organic apples; and
- Apple growers may target fresh produce markets for the additional organic price premium.

Organic and conventional producers grow largely different apple varieties in addition to the top five (table 2). For conventional apple producers, Rome—another dual-purpose variety—McIntosh, and Empire account for 6, 5, and 4 percent of harvested acres, respectively. For organic apple producers, Pink Lady—a relatively new variety—accounts for 7 percent of harvested acres and Braeburn and Pippin account for 4 percent each.

Most commercial apple trees in the United States are grown from a cutting of the desired apple variety that has been grafted onto a rootstock that determines the size of the tree. Trees range in size from dwarf to semi-dwarf to full-size (standard) and can bear fruit for many decades. Semi-dwarfs are the most popular type of tree currently used in apple production. In both organic and conventional systems, semi-dwarf trees were planted on nearly half of harvested apple acres in 2007 (table 2). The quantity (pounds) harvested per acre varied by tree size, but these differences were not statistically significant.

Table 2
**Characteristics of U.S. apple production in surveyed States, 2007**

| | All surveyed States | | Surveyed States[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Conventional | Organic | CA | MI | NY | NC | OR | PA | WA |
| | | | *All production* | | | | | | |
| **Tree size** *(percent of acres)* | | | | | | | | | |
| Standard | 29 | 27 | 37 | 11 | 19 | 29 | 23 | 14 | 27 |
| Semi-dwarf | 50 | 48 | 54 | 64 | 61 | 60 | 51 | 74 | 46 |
| Dwarf | 19 | 25 | 9 | 25 | 18 | 10 | 26 | 11 | 25 |
| Other | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 |
| **Tree density** *(trees per acre)* | 324 | 346 | 140 | 210 | 177 | 144 | 334 | 155 | 446 |
| **Top varieties** *(percent of production)* | | | | | | | | | |
| Red Delicious | 22 | 14 | -- | -- | -- | -- | -- | -- | -- |
| Golden Delicious | 14 | 11 | -- | -- | -- | -- | -- | -- | -- |
| Gala | 12 | 22 | -- | -- | -- | -- | -- | -- | -- |
| Fuji | 11 | 16 | -- | -- | -- | -- | -- | -- | -- |
| Granny Smith | 10 | 7 | -- | -- | -- | -- | -- | -- | -- |
| Rome | 6 | <1 | -- | -- | -- | -- | -- | -- | -- |
| McIntosh | 5 | <1 | -- | -- | -- | -- | -- | -- | -- |
| Empire | 4 | <1 | -- | -- | -- | -- | -- | -- | -- |
| Jonagold | 3 | <1 | -- | -- | -- | -- | -- | -- | -- |
| Pink Lady | <1 | 7 | -- | -- | -- | -- | -- | -- | -- |
| Braeburn | <1 | 4 | -- | -- | -- | -- | -- | -- | -- |
| Pippin | <1 | 4 | -- | -- | -- | -- | -- | -- | -- |
| Other | 13 | 14 | -- | -- | -- | -- | -- | -- | -- |
| **Nutrient use** *(percent of acres treated)* | | | | | | | | | |
| *Commercial sources:* | | | *Conventional production* | | | | | | |
| Nitrogen | 71 | -- | 41 | 58 | 79 | 56 | 66 | 45 | 81 |
| Phosphate | 24 | -- | 10 | 25 | 25 | 53 | 41 | 29 | 22 |
| Potassium | 35 | -- | 14 | 51 | 72 | 54 | 40 | 29 | 22 |
| *Commercial sources:* | | | *Organic production* | | | | | | |
| Nitrogen | -- | 57 | (D) | (D) | (D) | (D) | (D) | (D) | 67 |
| Phosphate | -- | 26 | (D) | (D) | (D) | (D) | (D) | (D) | 27 |
| Potassium | -- | 26 | (D) | (D) | (D) | (D) | (D) | (D) | 26 |
| *Noncommercial sources:* | | | | | | | | | |
| Compost | 3 | 49 | -- | -- | -- | -- | -- | -- | -- |
| Manure | 4 | 8 | -- | -- | -- | -- | -- | -- | -- |

-- = Data not available.
(D)=Withheld to avoid disclosing data for individual farms.
[1]Surveyed States accounted for over 87 percent of U.S. production.

Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

Producers can plant more densely by using smaller trees. Conventional producers in Washington State plant their trees more densely than any other State, at nearly 450 trees per acre, on average, and up to 2,000 trees per acre. In the other surveyed States, average tree density ranged from 140 trees per acre in California to 334 trees per acre in Oregon. According to David Granatstein at Washington State University Extension, planting density may be a reflection of orchard age, with older orchards having less density.

According to USDA scientists, "dwarf lines draw the attention of orchard owners because they improve apple tree productivity, are easier to prune and pick, and lead to more efficient use of pesticides" (Pons, 2003). Additionally, dwarf trees allow for earlier commercial harvest, and some apple producers now plant upwards of 1,000 trees per acre using high-density, supported production systems. Producers in one region may be able to maximize profits using higher tree densities than those in another region because of differences in climate, geography, and pest pressures.

**Yields.** Yields of conventionally grown fresh apples were highest in Washington State and lowest in North Carolina in 2007 (table 3). Apple production areas in North Carolina were damaged by a freeze that year, reducing yields. In Washington—the State with the most organic production—organic yields for fresh-market apples were 18 percent lower than conventional fresh yields for fresh-market apples.

Washington State accounts for the largest share of apples sold to the fresh market and the processing market. Washington State producers have a large volume of processing apples as a by-product of production for the fresh market. In contrast, Eastern and Midwestern producers often target the processing market, growing dual-market or processing-market apple varieties; in most of these States, average processing-market apple yields in 2007 were higher than average fresh-market yields.

Table 3
**U.S. apple yields for fresh and processing markets, by production system and State**

| State | Conventional yield | | Organic yield | |
|---|---|---|---|---|
| | Fresh | Processed | Fresh | Processed |
| | *Tons per harvested acre* | | | |
| California | 14.0 | 9.7 | 9.0 | 5.2 |
| Michigan | 9.6 | 11.1 | (D) | (D) |
| New York | 14.6 | 15.6 | (D) | (D) |
| North Carolina | 4.5 | 7.7 | ** | ** |
| Oregon | 10.6 | (D) | 3.6 | (D) |
| Pennsylvania | 10.6 | 17.0 | ** | ** |
| Washington State | 16.5 | 13.1 | 13.5 | (D) |

(D)=Withheld to avoid disclosing data for individual farms.
**=North Carolina and Pennsylvania had no respondents with certified organic acres.

Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

**Government Crop Insurance and Conservation Programs.** In 2007, over half of the apple producers in the surveyed States—54 percent of organic apple producers and 63 percent of conventional producers—covered their apple crops with Federal Crop Insurance. Organic producers are required to pay a surcharge for organic crop insurance and have been unable to obtain coverage using organic crop prices. Congress included a provision in the 2008 Farm Act that required the Federal Crop Insurance Corporation (FCIC) to study ways to improve organic production coverage. USDA's Risk Management Agency (RMA) made several changes for the 2011 production year, including organic price elections for a small set of crops (cotton, corn, soybeans, and processing tomatoes) and discontinuance of the organic surcharge for others (including Florida and Texas citrus fruits, pears, peppers, and prunes). RMA continues to accumulate data and works to improve production coverage for all crops, including apples (USDA, 2010).

A small number of apple producers—5 percent of conventional and 6 percent of organic producers—received payments in 2007 from the Environmental Quality Incentives Program (EQIP), one of USDA's major conservation programs. Congress included a provision in the 2008 Farm Act that has increased use of this program by organic and transitioning producers. The Organic Transition Support provision makes conservation practices related to organic production and transition eligible for EQIP payments, subject to a $20,000 annual limit and an $80,000 cap over a 6-year period.

**Organic Certification Fees.** Organic producers must pay the certifying agency a fee that covers the costs of inspections and other certifier activities. Certifying agencies set their own fees in a somewhat competitive environment since producers can choose their own certifying agency. Fees are typically based upon either the value of sales from certified acres or the number of acres certified.

In 2007, mean certification costs for apple producers were approximately $30 per acre in Washington State and California and approximately $70 per acre in Oregon. Differences in certification fees may vary among farms and States because of differences in certification fee structures, the number of acres certified, or differences in revenues. USDA has administered a national cost-share certification program since 2002 that reimburses organic producers up to 75 percent of their certification fees or up to $750 (see box, "U.S. Organic Regulations on Transition and Certification").

## U.S. Organic Regulations on Transition and Certification

In 2002—after decades of patchwork State regulations and voluntary private and State certification programs—USDA implemented national organic standards and required that all farmers and processors with over $5,000 in annual sales of products labeled as organic must be certified by a USDA-accredited group, see www.ams.usda.gov/nop.

Organic production is defined as an ecological production system that integrates cultural, biological, and mechanical practices that foster resource cycling, ecological balance, and biodiversity. USDA organic standards prohibit many inputs and methods that are commonly used in agriculture.

National organic standards address the methods, practices, and substances used to produce and handle crops, livestock, and processed agricultural products. Although specific practices and materials used by organic operations may vary, the standards cover every aspect of organic production and handling. These standards include a national list of approved synthetic and prohibited nonsynthetic substances for use in organic production systems. Seven criteria were established to evaluate substances for use in organic systems, including the toxicity and mode of action of the substance, the probability of environmental contamination during manufacture, use, and disposal, the effect on human health, and the effect on soil organisms, crops, and livestock.

In setting the soil fertility and crop nutrient management practice standard, USDA requires the producer to adopt practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion. The producer is required to manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials. Producers are also required to manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.

To label products as organic in the United States, producers must follow USDA organic production standards and be certified by a USDA-accredited certifier. Certifiers may be nonprofits or private companies, as well as State or local Government agencies. Producers are required to submit annual farm plans detailing what they will produce that year and how they will manage pests, nutrients, and other aspects of production. They must also undergo an annual inspection. Also, producers must use practices to prevent commingling of organic and nonorganic products and to prevent contact with prohibited substances throughout the supply chain.

A 3-year transition period is required for land used in organic production unless records prove that no prohibited substances were used in or near the production area during the previous 3 years. During the transition period, producers must use organic practices but cannot sell their produce as organic. The transition period is a significant hurdle for many producers because yields may dip during this period and producers do not have access to organic price premiums.

# Managing Apple Pests and Orchard Fertility

Apple growers routinely cope with a number of pests and diseases, and synthetic insecticides and fungicides have provided a straightforward, effective, and relatively inexpensive way to manage these pests since the 1950s. In the early 1990s, public concerns about the external effects of pesticides—potential dietary, drinking water, worker, and environmental hazards—spurred Congress to tighten pesticide regulations in the United States.

In 1996, Congress passed the Food Quality Protection Act (FQPA) to strengthen existing pesticide regulations, which are administered by the EPA, and to set new standards for pesticide residues on food. The EPA was directed to consider dietary exposure from all food uses and drinking water, homeowner pesticide use, the susceptibility of infants and children to pesticide residues, and the cumulative effects of pesticides that have a common mechanism of toxicity when setting the amount of pesticide residue (tolerance level) that may be found on food (Osteen and Livingston, 2006). FQPA also required a reassessment of all existing pesticide residue tolerance levels, prioritizing those posing the greatest risk to public health.

Pesticides classified as carcinogens, including those in the carbamate, organochlorine, and organophosphate families, were designated as high priority for reassessment. Many of the pesticides used in apple production are in the high-risk carbamate, organochlorine, and organophosphate families. Apple producers have reduced their use of some of these pesticides substantially over the last decade in response to regulatory changes. Certified organic apple production has also increased, and use of biological pesticides in conventional apple production systems is growing.

### *Conventional Producers Are Reducing Pesticide Use*

Although the use of several pesticides in the organophosphate family has declined substantially over the last decade, pesticides in this family were still used on more conventional apple acreage in the United States than any other type of pesticide in 2007. Approximately 81 percent of conventional apple acres received treatment with at least one organophosphate pesticide in 2007 to control insect pests (table 4). Use of the pesticides in this family has declined over the last decade in response to EPA pesticide use restrictions and cancellations. U.S. apple acreage treated with the top two organophosphate pesticides—Azinphos-methyl and Chlorpyrifos—has declined from 82 and 74 percent in 1997 to 62 and 59 percent in 2007 (USDA, NASS, 2008; USDA, NASS, 1998).

In 2001, the EPA completely phased out use of Methyl Parathion, an organophosphate that was used on 30 percent of U.S. apple acres in 1997 (USDA, NASS, 1998). The EPA is currently phasing out use of Azinphos-methyl, which the agency says poses unacceptable risks for farmworkers and has caused fish kills when sprayed over water. Use of Azinphos-methyl will be banned after the summer of 2012 (*Agro-News*, 2009). Pesticides in the organochlorine family were used only on 9 percent of conventional apple

Table 4

**Pesticides used in U.S. apple production in major apple-growing States, 2007**

| | | Conventional production | Organic production |
|---|---|---|---|
| U.S. bearing acres, surveyed States[1] | | 273,767 | 17,025 |
| | | *Percent of acres treated* | |
| Insecticides: | Carbamate (e.g., Carbaryl) | 35 | 0 |
| | Insect growth regulator | 31 | 0 |
| | Nicotinoid | 54 | 0 |
| | Organochlorine (e.g., Endosulfan) | 9 | 0 |
| | Organophosphate (e.g., Azinphos-methyl, Chlorpyifos) | 81 | 0 |
| | Pyrethroid | 29 | 0 |
| | *Materials allowed in organic systems:* | | |
| | Biological (e.g., *Bacillus thuringensis*, Spinosad)[2] | 22 | 52 |
| | Horticultural oil | 60 | 70 |
| | Kaolin clay | 2 | 13 |
| | Sulfur | 2 | 3 |
| Fungicides: | Aliphatic nitrogen | 3 | 0 |
| | Carbamate | 19 | 0 |
| | Conazole | 48 | 0 |
| | Dicarboximide | 34 | 0 |
| | Dithiocarbamate | 44 | 0 |
| | Pyrimidine | 20 | 0 |
| | Strobilurin | 31 | 0 |
| | *Materials allowed in organic systems:* | | |
| | Antibiotic | 18 | (D) |
| | Biological (e.g., *Bacillus subtilus, Bacillus pumilus*) | 4 | 28 |
| | Copper and sulfur | 33 | 40 |
| | Polysulfide (e.g., lime-sulfur solution) | 15 | 69 |
| | Potassium bicarbonate | 1 | 3 |
| Herbicides: | Dinitroaniline | 5 | 0 |
| | Phenoxy | 10 | 0 |
| | Phosphinic acid (e.g., Glyphosate) | 47 | 0 |
| | Pyridazinone | 4 | 0 |
| | Quaternary ammonium (e.g., Paraquat) | 12 | 0 |
| | Triazine | 10 | 0 |
| | Urea | 7 | 0 |

(D)=Insufficient reports to publish data.

[1]California, Michigan, New York, North Carolina, Oregon, Pennsylvania and Washington.
[2]Does not include pheromone traps and lures.

Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

acres in 2007. The top pesticide in this family used in apple production in 2007 was Endosulfan. Acres treated with this pesticide have declined by more than half since 1997, and all uses are scheduled to be phased out completely by 2016. Carbamates, which are also on EPA's high priority list for reassessment, were used on 35 percent of total conventional apple acreage in 2007 (see table 4).

Horticultural oils—usually refined petroleum oils combined with an emulsifying agent and sometimes plant-derived oils—are also widely used in apple production. In 2007, 60 percent of conventional apple acres were treated with horticultural oils (see table 4) to control insect and mite pests, down slightly from 65 percent of acres treated in 1997. The advantages of these products include safety to humans, effectiveness, and limited effects on beneficial insects, although they can injure plants if not used carefully (Cranshaw and Baxendale, 2010). The only other type of pesticide used on more than half of conventional apple acres in 2007 was nicotinoids.

### *Organic Producers Use Biological and Other Materials*

The Organic Foods Production Act of 1990 required the Secretary of Agriculture to establish the National List of Allowed and Prohibited Substances for use in organic agriculture. The list identifies synthetic substances that may be used and the nonsynthetic substances (natural) materials that are prohibited for use in organic production. In 2007, three of these approved materials were used on over half the organic apple acreage in surveyed States—horticultural oils to manage pests, lime-sulfur solution to manage disease, and biological controls to manage both insects and disease (see table 4). Other materials used to manage pests in organic apple production in 2007 include sulfur and copper, which are used under restrictions that prevent bioaccumulation in the soil. Horticultural oils, copper, sulfur, and lime sulfur are not considered carcinogenic, and the EPA has exempted them from a "pesticide residue tolerance"—the maximum amount of pesticide residue that may legally remain in and on foods (U.S. Environmental Protection Agency, 2010).

Approximately 13 percent of organic apple acres and 2 percent of conventional acres were also treated with a relatively new material—kaolin clay—to manage insect pests in 2007. Kaolin clay is an edible mineral that has long been used as an anticaking agent in processed foods, toothpaste, and other products and was developed for pest control about a decade ago (Ames, 2001). Kaolin clay is a nontoxic particle film spray that creates a barrier between the pest and the apple crop. The spray was developed by researchers at the USDA/ARS Experiment Station in Kearneysville, WV, in cooperation with the Engelhard Corporation (ATTRA, 2001).

### *Alternative Practices Used by Organic and Conventional Producers*

In both organic and conventional production, a variety of pest monitoring, prevention, and suppression tactics are also used. Pest monitoring behavior did not differ appreciably under conventional and organic production systems in 2007, nor did the use of diagnostic laboratory services for pest identification or soil plant tissue pest analysis (table 5). Most conventional and organic acres were deliberately scouted for pests. Some conventional and organic

Table 5
**Pest management practices in U.S. apple production, 1994-95 and 2007**

| Item | 1994-95 All production | 2007 Conventional production | 2007 Organic production |
|---|---|---|---|
| | *Percent of acres* | | |
| **Prevention practices:** | | | |
| Cultivate block for weed control* | . | 8 | 77 |
| Protect beneficial organisms* | 80 | 60 | 74 |
| Maintain beneficial insect or vertebrate habitat* | . | 49 | 73 |
| Clean implements after block work | . | 52 | 62 |
| Remove crop residue, leaf litter, or prunings | . | 67 | 58 |
| Practice water management** | . | 19 | 37 |
| Use flamer to kill weeds* | . | 2 | 26 |
| Choose crop variety for pest resistance | 10 | 8 | 16 |
| Use nonchemical controls for deer | . | 11 | 5 |
| **Monitoring practices:** | | | |
| Deliberate scouting activities | 84 | 89 | 84 |
| Weather monitoring | . | 86 | 68 |
| Soil/plant tissue analysis to detect pests | 31 | 18 | 30 |
| Scouting by general observation | . | 10 | 14 |
| Block was not scouted | . | 2 | 1 |
| **Suppression practices:** | | | |
| Pheromones and floral lures* | 15 | 63 | 81 |
| Biological pesticides (Bt, Neem, insect growth regulators)* | . | 43 | 79 |
| Ground cover or physical barriers | . | 70 | 77 |
| Buffer strips or border rows* | . | 14 | 65 |
| Beneficial organisms** | . | 11 | 26 |

. = Not available in previous surveys.
* =Difference between organic and conventional is statistically significant at the 1-percent level.
** =Difference between organic and conventional is statistically significant at the 10-percent level.

Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service (NASS) and Economic Research Service; the 1994 and 1995 Chemical Use and Pest Management Practices Surveys conducted by NASS.

acres were scouted for pests while personnel performed other duties in the field, and only a small amount of acreage (1-2 percent) was not scouted for pests.

Some pests affect apples in all regions of the United States. Most conventional and organic acres, for example, were scouted for weeds, coddling moth, aphids, thrips, apple scab, powdery mildew, and fire blight, and estimates of the shares of producers using this practice are not statistically different by production system. Only about half of conventional acres and organic acres were also scouted for flyspeck/sooty blotch. Significantly more conventional (41 percent) acres, however, were scouted for plum curculio than organic acres (18 percent). Plum curculio mostly affects apple producers

in the Eastern United States, and most U.S. organic apple acres are in the Western States.[2]

The biggest difference in prevention practices between organic and conventional systems is for weed management. Conventional producers use a number of chemical herbicides to manage weeds in tree rows (see table 4), while organic producers cultivate the rows and use other strategies to suppress, control, and kill weeds (see table 5). A flamer was used to kill weeds on 26 percent of organic acreage, significantly higher than use on conventional acreage (2 percent). Weather data were used on a greater percentage of conventional acres (87 percent) than organic acres (68 percent) to determine the need for or the timing of pesticide applications. The effectiveness of pesticides applied to conventional acres may be more dependent on specific weather patterns than those applied to organic acres.

Crop residue, leaf litter, and pruned tree parts were removed from most conventional and organic acres to eliminate sources of insects and disease. Water management practices, such as irrigation scheduling, controlled drainage, or treatment of retention water, were used on a greater percentage of organic than conventional acres to control for pests. Other prevention practices include the use of tree varieties resistant to specific pests (with significantly higher use among organic producers) and cleaning equipment and field implements to prevent the spread of disease and weed seeds.

Biological pest management practices and products were used extensively in organic and conventional apple production systems in 2007 to suppress insect and other pest populations (see table 5). Pheromones and floral lures were used on a higher percentage of organic apple acres than on conventional acres in surveyed States in 2007. Beneficial insects or vertebrate habitats were also used as a pest prevention practice on a higher percentage of organic than conventional acres (see table 5). Similarly, beneficial organisms were a factor in pest control decisions on a greater percentage of organic than conventional acres. Finally, beneficial organisms, including insects, nematodes, and fungi, were applied or released on a significantly greater percentage of organic than conventional acres.

Conventional and organic apple producers also reported differences in other pest suppression practices. Buffer strips or border rows were maintained to isolate organic apples from nonorganic apples or land on a much higher percentage of organic than conventional acres. Organic producers are required to maintain a buffer strip between their organic crop acreage and land that receives treatment with prohibited substances, including neighboring farms that use conventional production practices. Some conventional growers that reported using buffer strips may have used them because they also have organic acreage.

A USDA survey conducted in the mid-1990s also asked apple producers about their pest management practices. A comparison of data from this survey data reveals that the only practice to increase substantially between the mid-1990s and 2007 was the use of pheromones and floral lures (see table 5).

[2]Plum curculio are tree fruit weevils native to regions east of the Rocky Mountains. They cause large scars and bumps on the fruit from where they feed. Most fruit are damaged when the pest burrows into the flesh, causing the fruit to drop prematurely.

### *Organic and Conventional Producers Use Different Nutrient Sources*

Although the nutrient sources are different, most organic and conventional apple producers in the United States use nitrogen on their crops (see table 2). Commercial phosphate and potassium are used on less acreage—about a third of organic and conventional acres. Nutrient sources used by conventional producers include both synthetic fertilizers and organic sources, such as commercially prepared manure or compost.

Purchased nitrogen inputs were used by both conventional and organic producers—synthetic nitrogen was used on 71 percent of conventional apple acres in 2007 and nitrogen from natural sources was used on 57 percent of organic apple acres. Nearly half of organic acres were treated with noncommercial compost, compared with only 3 percent of conventional acres. A relatively small amount of apple acres were treated with animal manure—8 percent of organic acres and 4 percent of conventional acres—although these estimates are not statistically different. Poultry manure was the source for most of these treatments. For conventional producers, the U.S. Food and Drug Administration (FDA) has issued voluntary food safety guidance, recommending that growers consider incorporating raw manure into the soil prior to planting to reduce pathogens and that growers avoid applying raw manure to produce fields during the growing season (FDA, 1998). For organic producers, USDA organic regulations require that raw manure be composted before use in crop production, unless it is incorporated into the soil not less than 120 days prior to harvest of a product whose edible portion is in contact with the soil or 90 days prior to harvest if the edible portion does not touch the soil (USDA, AMS, NOP, 2000).

A soil test for phosphorous and nitrogen was performed on a higher percentage of organic apple acres (83 percent) in 2007 than on conventional acres (31 percent). Similarly, a nitrogen test was performed on 86 percent of treated organic acres and only 43 percent of conventional acres. In addition, a plant tissue test, or leaf analysis for nutrient deficiency, was performed on a much higher percentage of organic (71 percent) than conventional (28 percent) acres. Not surprisingly, nitrogen was applied based on the results of a soil or plant tissue test on a significantly higher percentage of treated organic acres (76 percent) than treated conventional acres (40 percent). Nitrogen application decisions were based on recommendations of crop consultants on 67 percent of treated organic acres and 33 percent of treated conventional acres.

# Marketing and Prices in the U.S. Apple Sector

Apples are one of the most popular fruits in the world and, along with grapes and oranges, are still one of the top three fruits consumed in the United States. Although consumption of fresh apples in the United States has trended down for several decades, demand from other countries for fresh apples from the United States has expanded during this period, and U.S. apple exports are substantially higher than apple imports. Approximately 25 percent of the domestic supply of fresh apples is exported to Mexico, Canada, Taiwan, and other countries, up from a 12-percent share during the 1980s. Fresh apple exports, which were 697 million pounds in the 1980/81 marketing season, reached a record high (1.72 billion pounds) in the 2008/09 marketing season (USDA, ERS, 2009). Approximately 7 percent of the fresh apple supply in the United States is imported, mostly from Chile, New Zealand, Canada, and Argentina (Huang and Huang, 2007).

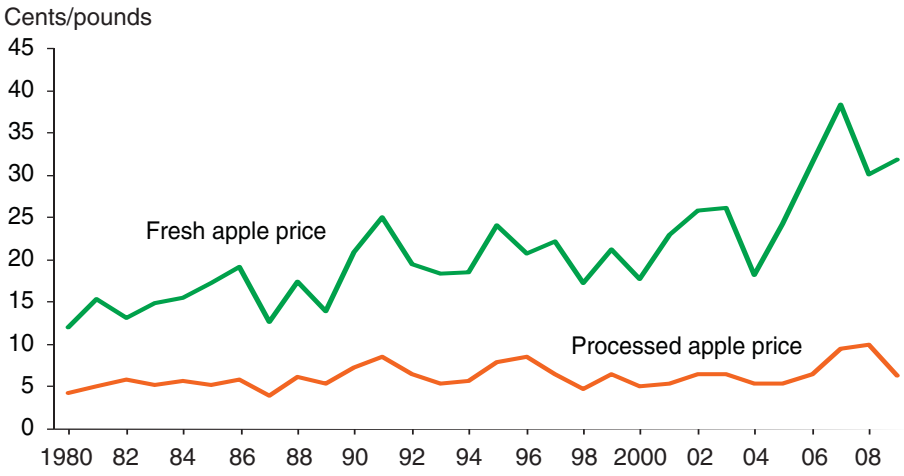
In January 2011, the U.S. Department of Commerce added codes for selected organic products, including fresh apples, to the U.S. trade code system, and USDA's Foreign Agricultural Service (FAS) has begun reporting trade statistics on these products. During the first quarter of 2011, the U.S. exported fresh organic apples to Canada, Mexico, and 11 other countries, accounting for 4 percent of U.S. apple export value. The U.S. imported organic apples from three countries during this period—Canada, Chile, and Argentina—accounted for 5 percent of total apple import value. FAS expects organic trade data to improve as shippers adjust to these new codes and as coverage of organic products expands.

In general, U.S. apple producers sell their higher-quality apples for fresh-market consumption at higher prices and sell their lower-quality apples to processors at lower prices. Many apple producers, however, especially in Eastern and Midwestern States, target markets for applesauce, juice, cider, and other processed apple products, including pre-sliced apples. The share of U.S. apples sold for juice has dropped as low-cost producers, particularly China, have entered the market.

Almost two-thirds of U.S. apple production is now sold in markets for fresh apples, up from an average of 56 percent in the 1980s. Although prices for apples used in processing have remained essentially flat for several decades, grower prices for fresh apples have gradually trended up (fig. 5). The farm share of consumer expenditures on fresh apples has also edged higher in the last several years, reaching 31 percent of consumer expenditures in 2008.

Apple producers in the United States typically sell their harvested apples through packers, shippers, brokers, and other market intermediaries. Some producers also pack their own apples and have their own shipping operations. A small but increasing number of producers also sell their apples directly to consumers. Over 6 percent of U.S. farmers reported selling agricultural products directly to consumers in 2007, up from 5 percent in 2002 (USDA, ERS 2009). Among those apple producers using direct markets in 2007, direct sales were mostly through farmers markets or consumer-supported agricul-

Figure 5
**U.S. grower prices for fresh apples trend up**




Source: USDA, National Agricultural Statistics Service, *Noncitrus Fruits and Nuts Summary*, various issues.

ture (CSA) arrangements in Western States and onfarm or roadside-stand sales in other States.

Price premiums for organic apples exist across the supply chain, likely reflecting higher production and handling costs than for conventional apples as well as rising consumer demand. At the producer level, organic systems tend to have higher labor costs (that are not offset by lower chemical costs) than conventional systems and must also cover the higher costs incurred during the 3-year transition period (Greene et al., 2009). Organic producers and handlers also incur extra costs for certification, inspection, additional paperwork, and product segregation. Although retailers are not required to be certified, they are required to maintain purchase records, segregate organic products from conventional products in warehouse and display areas, and produce records upon demand by USDA. These activities may create additional costs at the retail level.

Most of the U.S. apple harvest is transported to warehouses for grading, packing, and storage before being sold into markets for fresh apples. In 2007, 72 percent of conventional apples and 82 percent of organic apples sold through market intermediaries in the surveyed States were sold for fresh consumption. Apples for the fresh market are generally bagged or boxed for sale to grocery stores, warehouse stores, and exporters.

The rest of the U.S. apple harvest is sold to processors for applesauce, apple juice, and other processed apple products. The market for "peelers"—apples used to make applesauce, pies, and canned fruit—claimed 11 percent of the organic apples and 14 percent of the processed conventional apples sold through market intermediaries in 2007 (table 6). The juice market accounted for 15 percent of the conventional apple packout, but only 6 percent of the organic packout.

Table 6
**Farm-level organic price premiums varied by market, 2007[1]**

| Market | Organic production | Conventional production | Average price | | | Organic premium |
|---|---|---|---|---|---|---|
| | | | All apples | Organic[3] | Conventional[3] | |
| | *Market sales (percent of harvest[2])* | | *$/pound* | | | *Percent* |
| Fresh apples | 82 | 72 | 0.28 | 0.55 | 0.25 | 120 |
| Peelers (sauce) | 11 | 14 | 0.09 | 0.16 | 0.09 | 72 |
| Juice | 6 | 15 | 0.09 | 0.18 | 0.08 | 119 |

[1]Seven surveyed States accounted for over 87 percent of U.S. production.
[2]Excluding sales made directly to consumers.
[3]Organic and conventional price differences are statistically significant.

Source: USDA, Economic Research Service calculations based on data from the 2007 Agricultural Resource Management Survey, conducted by National Agricultural Statistics Service and Economic Research Service.

### *Organic Premiums Highest at the Producer Level*

The average price for all uses of organic apples sold through market intermediaries was substantially higher than that for conventional apples in 2007 (table 6). For fresh apples, growers received $0.55 per pound, on average, for organic apples, compared with $0.25 per pound for conventional apples; growers received $0.16 per pound for organic apples for juice, compared with $0.09 per pound for conventional apples.

Organic apple markets are still developing and are not easily accessible to growers in all parts of the country. As a result, many organic apples are sold as conventional apples. Approximately 23 percent of the organic apples produced in the surveyed States were sold as conventional apples in 2007. Although Washington State is the market leader in organic apple production, 18 percent of its organic apples were sold as conventional apples. Other States had an even higher level of organically produced apples sold in conventional markets—Oregon (29 percent), New York (37 percent), and California (49 percent). In 2001, over a third of the respondents to a nationwide survey of organic producers conducted by a California nonprofit indicated that they sold some of their organic product into the conventional market (Organic Farming Research Foundation, 2001). Over half of these respondents indicated that they sold organic product into the conventional market because an organic market was unavailable. Almost a third indicated that the conventional price was good or high, 16 percent said that they sold their culls as conventional product, and 15 percent said the organic price was too low.

### *Organic Prices Track Conventional in Wholesale Markets*

Although the proportion of produce shipped directly from growers is increasing, terminal markets, such as the San Francisco Terminal Market, still serve as a hub for spot market purchases of fruits and vegetables. USDA has tracked wholesale prices at terminal markets for some organic produce items, including organic apples, for a number of years. Although much of the apple harvest and the production of other fruits and vegetables now goes directly to retailer distribution centers rather than through wholesale markets, organic

and conventional price trends can be more easily compared using data from wholesales.

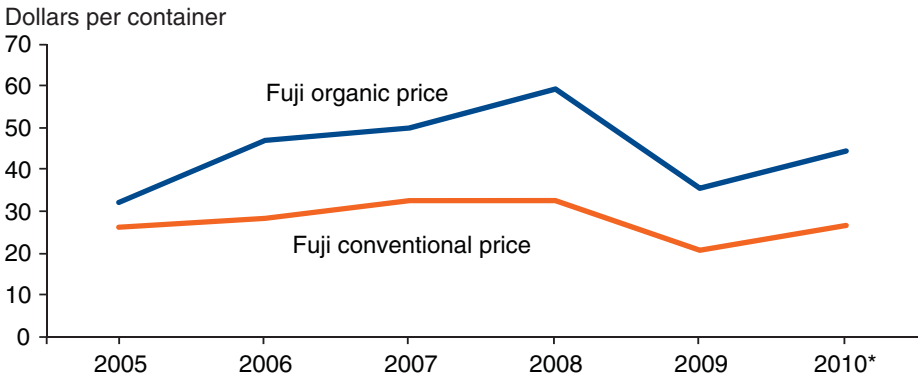
Since 2005, Fuji, Gala, and Red Delicious have been among the most consistently reported organic apple varieties in the San Francisco Terminal Market. Organic price premiums for Fuji and Red Delicious apples were fairly stable and averaged at about 60 percent for 2005-09 and for the first half of 2010 (fig. 6). Organic price premiums for Galas averaged at about 55 percent for 2007-09 and the first half of 2010. Prices were higher for the new varieties—Gala and Fuji—than for Red Delicious in both conventional and organic markets. For all three apple varieties, organic wholesale price movement has tracked conventional price movement since 2005 (fig. 6).

ERS analysis of retail prices for organic and conventional fruits and vegetables using 2005 Nielsen Homescan data from a nationally representative panel of consumers also shows consistent organic retail price premiums for apples (Lin et al., 2008). The organic premium as a percent of the corresponding conventional price was less than 30 percent for over two-thirds of the 35 fresh fruits and vegetables examined. The organic premium for apples in 2005 was 34 percent, higher than for most of the other fresh fruits and vegetables. ERS examined organic retail price premiums in several earlier years using Nielsen Homescan panel data and found that the organic price premium for apples was 28 percent in 2001 and 36 percent in 2004 (Stevens-Garmon et al., 2007).

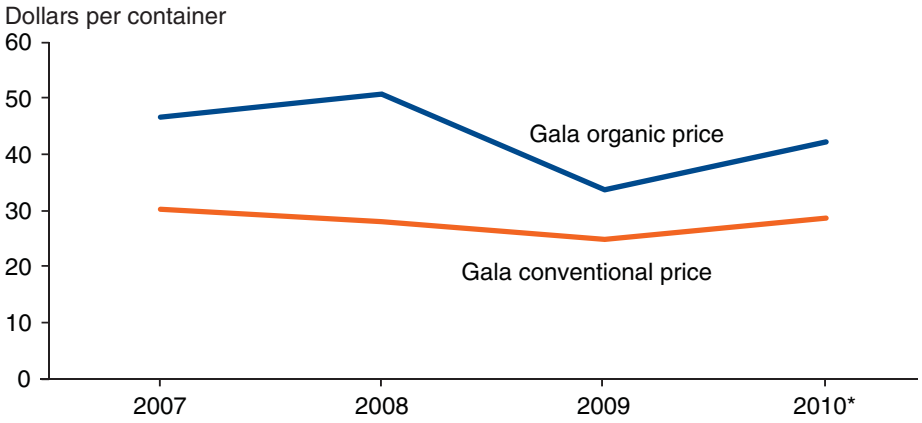
Figure 6

**Price movement similar for organic and conventional apples**

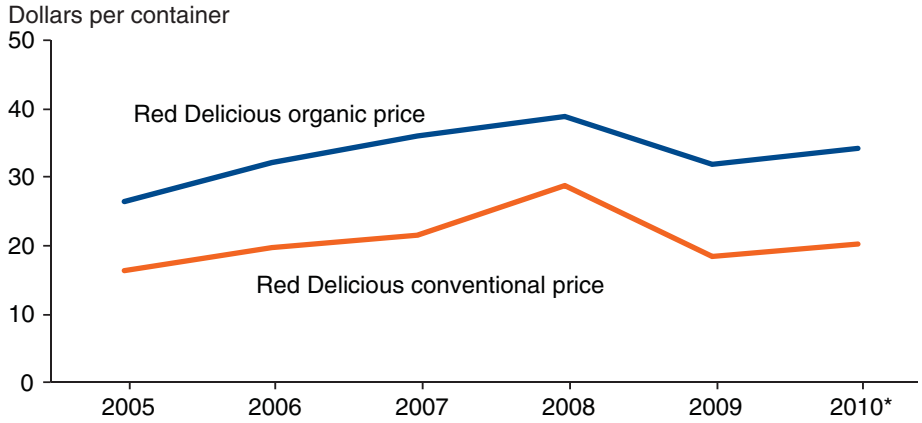
***Average annual Fuji apple prices, San Francisco Terminal Market[1]***




***Average annual Gala apple prices, San Francisco Terminal Market[1]***




***Average annual Red Delicious prices, San Francisco Terminal Market[1]***




*2010 estimate includes January-June prices.

[1]Cartons, tray pack, or cell pack (approximately 40 pounds).

Source: USDA, Agricultural Marketing Service, average annual prices, *San Francisco Terminal Market News Report*.

# Conclusions

The U.S. apple industry—orchards, crop acreage, and production—has been declining for well over a decade as domestic consumption of fresh apples declined and foreign competition for the processed apple market increased. Apples have faced increased competition for the U.S. fresh fruit market in the last several decades—per capita consumption of fresh strawberries and pineapples, for example, has more than doubled—but overall consumption of fresh fruits has remained nearly flat and is well below recommended levels (U.S. Centers for Disease Control and Prevention, 2007). If successful, recent public health initiatives aimed at reducing childhood obesity and improving the health of Americans by increasing the consumption of and access to nutritious food could spur increases in the fresh fruit market and help counter the decline in fresh apple consumption.

Although overall consumption of fresh apples has declined, consumption of varieties other than Red Delicious has increased substantially in recent years. According to researchers at Washington State University, Red Delicious accounted for as much as 70 percent of the apples grown in Washington in the mid-1990s, but the share has declined as consumer demand for other varieties has risen. Two other markets have continued to show strong growth during this period—export markets for fresh apples and domestic markets for organically grown apples. World demand for organic products is still expanding, and export markets also have strong potential for U.S. organic apples.

Conventional and organic production systems shared many similarities in 2007, including the predominance of dwarf and semi-dwarf trees, tree density, and a general focus on apples for the fresh market. These systems differed primarily in their pest and nutrient management strategies, which can be costly and difficult to implement in organic systems. Adoption of organic systems is much higher in Western States, partly reflecting the lower pest pressure in those States.

Strong price premiums have attracted growers to organic production systems. According to ERS analysis, grower prices for fresh organic apples and organic apples for juice in 2007 were more than twice as high as grower prices for fresh conventional apples and conventional apples for juice. Increased funding for organic pest management research could facilitate organic production in Eastern States, and also play a key role in helping growers reduce costs as organic production increases. In surveys of organic producers, insect management, disease management, and weed control are consistently identified as the top research priorities. Increased research on organic pest management would also benefit conventional growers as the United States implements tighter pesticide regulations.

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