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U.S. Certified Organic Dairy Production: Three Decades of Growth

Jeffrey Gillespie, Sharon Raszap Skorbiansky, and Jonathan Law

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Abstract

United States' organic dairy production has grown over the past three decades. This study uses USDA's Agricultural Resource Management Survey data from 2005, 2010, 2016, and 2021 (along with other USDA data) to examine changes in farm structure, production costs, technology adoption, and challenges facing organic dairy producers. As organic dairy markets evolved (along with regulatory changes in production standards), organic milk production and the number of organic dairy operations increased. The report shows that the growth of organic milk production has differed by U.S. State, with regional differences in farm structure and cost of production. From 2005 to 2021, there have been modest changes in organic dairy farm structure and adoption of technology, with larger farms more likely to utilize advanced technologies and production systems and benefit from economies of scale.

Keywords: organic agriculture, organic production costs, farmers, organic label, costs and returns, dairy farming, dairy technology

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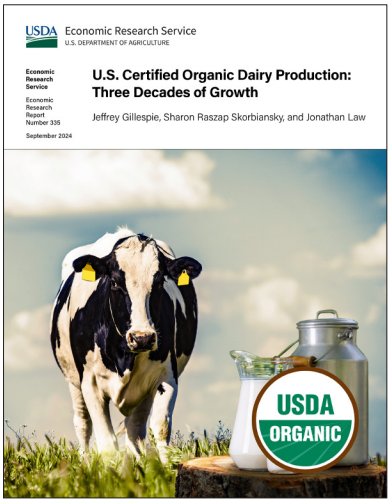
What Is the Issue?



Responding to increased consumer demand for organic milk, U.S. dairy farmers increased the production of organic milk over the last three decades. USDA's National Organic Program (NOP) was established in 2000 (and implemented in 2002) in response to the Organic Foods Production Act of 1990 and has undergone several rule changes for certified organic dairy farms since then, particularly regarding the transition of dairy cows from conventional to organic and forage requirements from pasture. The USDA's Agricultural Resource Management Survey (ARMS) dairy version surveyed both certified organic and conventional (nonorganic) dairy farms in 2005, 2010, 2016, and 2021, allowing for the estimation of costs and returns for both certified organic and conventional dairy production. These surveys have also allowed for charting the structure of certified organic dairy farms by farm size and U.S. region. This report discusses how NOP created national standards and facilitated market development for organic products; how certified organic dairy farms have changed over the past two decades; and how certified organic dairy farms differ in structure, costs, and returns by farm size and region of the United States.

What Did the Study Find?

Over the past two decades, several trends and/or patterns in organic milk production are noted:

- Regulations for certified organic milk production have evolved since NOP's inception. Rule changes have dealt primarily with the transitioning of dairy animals from conventional to organic and pasture requirements for organic milk production.
- U.S. organic dairy production has increased over the last two decades, and some shifts in State rankings of organic milk production have occurred.
- ARMS dairy data show modest changes in organic dairy farm structure over the 2005–21 period, though interpretation of the results should consider that no large Texas organic dairy farms are included in the 2016 or 2021 ARMS dairy data. Texas was the largest organic milk production State in 2021 and the second largest in 2016.

- Certified organic dairy farms have experienced profitability in some years. Of the 4 ARMS dairy survey years (i.e., 2005, 2010, 2016, and 2021), the average certified organic dairy farm covered feed costs and operating costs in all years, and total economic costs in 2016.
- For the 4 ARMS dairy survey years, organic dairy producers cited certification paperwork requirements as the most difficult aspect associated with certified organic dairy production. The relatively high cost of production was the second-most difficult aspect for 3 of the 4 survey years.

Relative to small certified organic dairy farms, larger certified organic dairy farms, on average:

- Produced more milk per cow; were greater adopters of selected advanced technologies, management practices, and production systems; and depended more heavily on purchased rather than homegrown feeds and paid (hired) labor rather than unpaid (typically family) labor.
- Experienced lower total economic costs per 100 pounds of milk sold and higher returns over total economic cost.

Relative to conventional dairy farms, certified organic dairy farms, on average:

- Received higher prices for milk and incurred higher feed costs per 100 pounds of milk sold, although the premiums for certified organic milk varied over time.
- Experienced higher return over operating costs and return over total economic costs compared with similar sized conventional dairy farms in 2016 and 2021.

Regional differences were found among certified organic dairy farms, including:

- Western certified organic dairy farms tended to adopt advanced technologies, management practices, and production systems at greater rates; depended less heavily on homegrown, relative to purchased feeds; and incurred lower capital recovery costs than certified organic dairy farms in other regions.
- Although northeastern-certified organic dairy farms received among the highest milk prices, these farms also incurred among the highest feed costs per 100 pounds of milk sold.

How Was the Study Conducted?

This study relied on data from several sources, primarily the USDA's ARMS and various organic agricultural data sources reported by USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service (NASS). The most recent four ARMS dairy surveys included oversamples of organic dairy farms, which has allowed us to analyze the costs and returns, structure, and adoption of various technologies, practices, and production systems on organic dairy farms. Periodic surveys conducted by USDA, ERS and USDA, NASS allowed for charting milk cow inventories and farm numbers over the past two decades. Publications and documentation from other USDA agencies, such as the Agricultural Marketing Service, allowed for charting the progress of rulemaking over the course of NOP from its inception in 1990.

Introduction

Over the past three decades, consumers have increasingly demanded milk and dairy products that meet USDA organic standards, leading to an expansion of U.S. certified organic milk production.[1] The U.S. Organic Foods Production Act of 1990 (OFPA) authorized the start of the USDA, Agricultural Marketing Service's (AMS) National Organic Program (NOP) and required the creation of uniform national organic standards for marketing agricultural products as certified organic. Before the OFPA, organic standards differed from one State to the next. Today, NOP oversees national standards for the production and handling of organically produced agricultural products. These standards address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products.

In addition to compliance with organic standards that apply to all products (e.g., prevention from commingling with nonorganic products), organic dairy operations must meet the standards set by the NOP's Organic Livestock Requirements (USDA, Agricultural Marketing Service (AMS), 2013; USDA, AMS, 2023). Organic dairy cows must be fed organically grown and prepared feed, with at least 30 percent of dry matter intake being pasture or residual forage during the grazing season; be managed without the use of antibiotics,[2] growth hormones, or feed ingredients prohibited in the USDA, AMS National List of Allowed and Prohibited Substances; and live in conditions that accommodate health and natural behavior (e.g., access to outdoor areas, shade, shelter, space for exercising). Furthermore, breeding stock must be kept under continuous organic management during at least the last third of their gestation period. Additional provisions are in place for transitioning nonorganic animals to organic production. For information on how standards have evolved since their inception, see the box "Changes in Organic Dairy Production Requirements."

Dairy farmers have transitioned from conventional to organic milk production for various reasons—some of which may include a desire to produce a product that is perceived to be healthier, interest in farming using sustainable agriculture practices, and expectations of a more profitable farm. In this report, we discussed the increase in certified organic dairy production since 2000; provided information about the regulation of organic dairy production; examined trends in production costs and technology adoption in certified organic production; and examined differences in production costs and technology by farm size and region of the United States. For the purposes of this report, when we discuss "organic dairy production," we are referring to certified organic dairy production, as surveyed by USDA's Agricultural Resource Management Survey (ARMS) and not exempt organic production.

[1] Not all organic farms are certified. USDA regulations exempt operations with values of $5,000 or less in organic annual sales from certification. These operations may choose to become certified, but if they opt out of certification, the operations have the right to market their products as organic but may not use the organic seal (the USDA organic logo). Additionally, if exempt farms choose to not seek certification, their products cannot be listed as organic if used as ingredients in a different processor's or handler's multi-ingredient product.

[2] USDA, AMS (2023) provides information about antibiotic use for organic dairies. Although organic dairy farms must use antibiotics to prevent animal suffering or save an animal's life—the event must be recorded in health records, the certifier must be notified, the animal must be segregated to prevent contamination of organic products, the animal must be sold in a nonorganic market, and the sale of the animal must be documented. Cows providing milk for human consumption are not treated with antibiotics, whether conventional or organic. Conventional milk from treated cows must be discarded, and organic milk must come from an organic cow that has never been treated with antibiotics.

Changes in Organic Dairy Production Requirements

The U.S. Organic Foods Production Act (OFPA) of 1990 was passed by Congress to create a uniform standard of organic certification, establish a list of permitted and prohibited substances, and authorize the creation of the USDA, Agricultural Marketing Service's (AMS) National Organic Program (NOP). Generally, the legislation and the proceeding rules, as created by NOP, require milk and milk products intended to be sold or labeled as organic must originate from dairy animals raised organically for 12 months prior to the sale of the product. However, the NOP final rule issued by USDA, AMS in 2000, which took full effect in 2002, allowed producers converting a whole herd to have reduced transition time. The reduction allowed producers to feed 80 percent organic or self-raised feed for the first 9 months of a herd's transition and then required fully organic feed for the final 3 months prior to organic milk production. Proponents of this 80/20 rule argued that requiring 100 percent organic feed for a transitioning operation was economically prohibitive, whereas arguments against the rule included that the rule would create a permanent exemption and that split operation dairies could use the rule repeatedly to bring nonorganic animals into the organic operation.

Over the past two decades, exemptions for transitioning producers have changed. These exemptions included an amendment to OFPA that allowed the use of pasture and crops in their third year of transition, a removal of the 80/20 rule, and final rules published in 2022 that provided new provisions for transitioning herds. The 2022 Final Rule clarified that a nonorganic dairy operation may transition to organic production on a one-time basis, with all animals ending their transition at the same time after a 12-month period of organic management. Once the operation has transitioned the dairy animals, that operation cannot transition additional animals or source transitioned animals. Any dairy animal added thereafter must have been organically managed from the last third of gestation (i.e., about 3 months before birth). Appendix table A.1 details key changes in organic dairy production requirements from 1990 to 2022.

Data Used for the Study

Data used for this study to examine changes in the cost of production and structure of organic dairies are drawn from the USDA's ARMS dairy surveys. The ARMS is conducted annually by USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service (NASS) to survey U.S. farms to collect information on farm and farm household economic indicators, and costs, returns, and production practices that can be reported by commodity. For the 12 commodities regularly targeted by USDA's ARMS, surveys are conducted on a rotating basis every 4 to 10 years, depending on the commodity. The four most recent ARMS dairy surveys were conducted in 2005, 2010, 2016, and 2021, with oversamples drawn each year for organic dairy farms to develop organic cost and return estimates. The ARMS dairy versions surveyed dairy producers in 24, 26, 28, and 28 U.S. States in 2005, 2010, 2016, and 2021, respectively.[3] These States included at least 90 percent of the U.S. dairy cow inventory on farms, with at least 10 dairy cows in inventory at some point during the survey year, and farms with sales of more than $1,000. The weights for each farm that are included in the data allowed the sample to be extended to represent at least 90 percent of U.S. dairy

[3] States included in the USDA 2005 ARMS dairy survey are: Arizona, California, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Michigan, Minnesota, Missouri, New Mexico, New York, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Vermont, Virginia, Washington, and Wisconsin. For 2010, Colorado and Kansas were added. For 2016 and 2021, South Dakota and Utah were added.

production on farms with at least 10 dairy cows. Previous studies have used the ARMS dairy data to examine the characteristics of organic dairy farms. These studies include McBride and Greene (2009) and Mayen et al. (2010), using 2005 data, and Nehring et al. (2021) and Dimitri and Nehring (2022), using data up to the 2016 survey.

This report also drew on data sources from several USDA agencies to examine trends on inventories of dairy cows, numbers of organic dairy operations, and sales of organic certified milk. From 1997 to 2011, USDA, ERS conducted certifier-based surveys as part of the USDA, ERS Organic Production Data, which collected information on certified milk cow inventories. Starting in 2008, USDA, NASS began collecting information on certified organic agriculture via various producer surveys, though the agency does not conduct organic producer surveys on an annual basis. Since the USDA, NASS' 2007 Census of Agriculture, the agency has conducted an organic Census Special Study after each Census (e.g., 2008 Organic Production Survey, 2014 and 2019 Organic Surveys). Additionally, USDA, NASS conducted the Organic Survey in 2011, 2015, 2016, and 2021. USDA, NASS coordinated with USDA, Risk Management Agency (RMA) in the production of the 2011 and 2021 surveys. These producer surveys collect information on certified organic milk cows (i.e., inventory and value of sales) and certified organic cow milk (i.e., number of farms with sales, quantity sold, and value of sales). Additionally, USDA, AMS collects comprehensive statistics on milk and milk markets as part of the Federal Milk Marketing Orders (FMMO). The estimated U.S. sales of organic fluid milk products are published monthly by USDA, AMS in its *Estimated Fluid Milk Products Sales Report*.

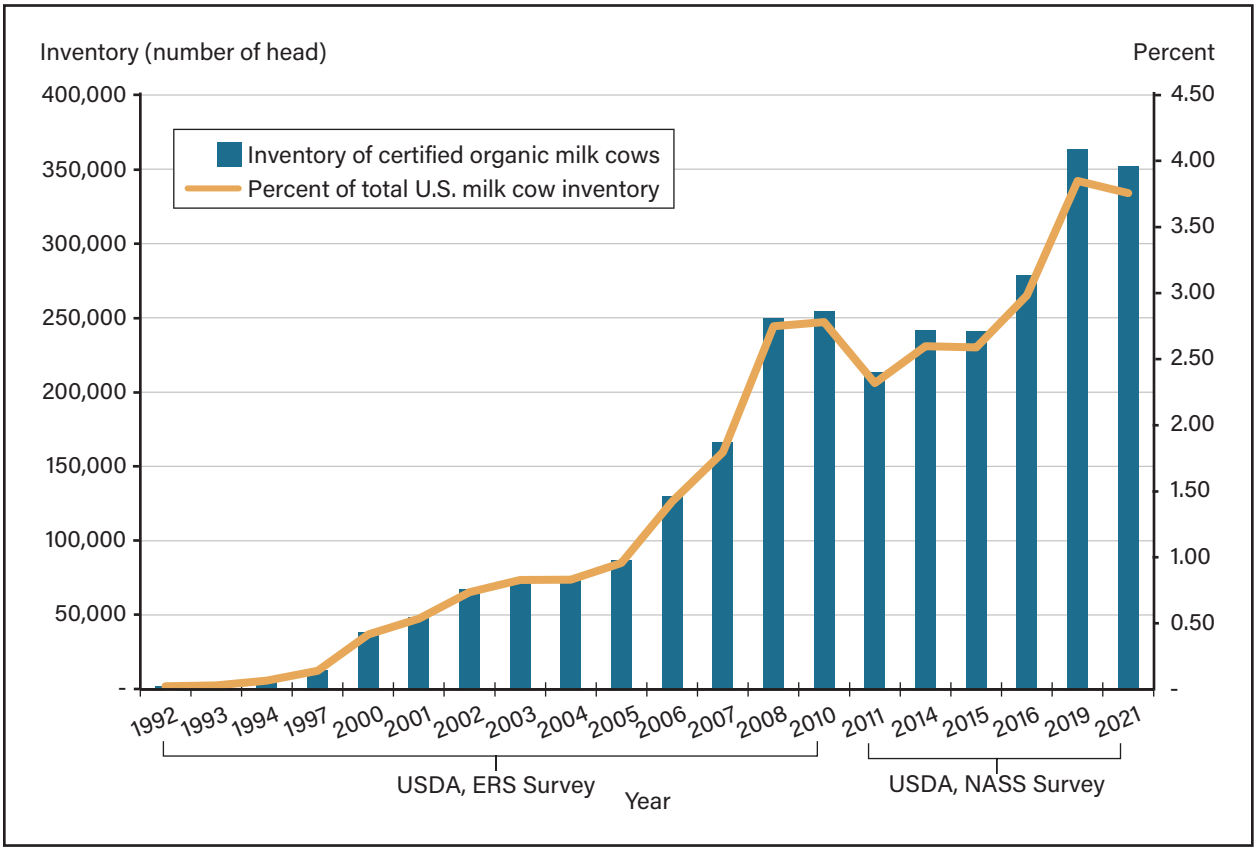
U.S. Certified Organic Dairy Production Growth

U.S. organic dairy production has increased over the past three decades, as shown through increases in milk cow inventories (figure 1). Quantities of organic milk sold at the farm level (figure 2), and of fluid milk sold (figure 3), have also shown growth. In response to increased consumer demand for organic milk, producers expanded the U.S. organic milk cow inventory sharply from 2,265 cows to 352,289 cows from 1992 to 2021. As a share of the total U.S. milk cow inventory, the organic milk cow inventory increased from 0.02 percent to 3.76 percent during the same period. From 2010 to 2011, the reported inventory of organic milk cows fell from about 255,000 to 213,000 and did not rise above the 2010 level until 2016 (figure 1). However, the 2011 reduction may be related to a change in data collection responsibilities and differences in survey methodology. From 1992 to 2011, USDA, ERS administered a survey of USDA-accredited State and private organic certifiers to determine U.S. organic livestock and production acreage. In 2008, USDA, NASS began collecting organic data as an add-on to USDA, NASS' Census of Agriculture. Unlike USDA, ERS, USDA, NASS typically uses a producer-based survey, which generally yields lower estimates than certifier-based surveys (Carlson et al., 2023). Furthermore, USDA, ERS data show the total number of cows certified as organic during the year, whereas USDA, NASS data show the peak inventory of certified organic cows during the year. Comparing USDA, ERS and USDA, NASS for years when both sources were available (i.e., 2008 and 2011) has shown that USDA, ERS inventories were 14 percent and 22 percent higher, respectively. The percentage of farm milk sales that were organic increased from 1.5 percent in 2008 to 2.4 percent in 2019 but slightly declined to 2.3 percent in 2021 (figure 2).

Along with an increased organic milk cow inventory, sales of organic fluid milk to consumers increased by 78 percent from 2009 to 2022 (figure 3). Increased organic fluid milk sales came at a time of continued annual decline in total U.S. per capita fluid-beverage milk sales for almost every year between 1975 and 2021, with sharper declines in the 2010s (about a 2.6 percent decline annually) than during the 2000s (about a 1.0 percent decline annually), as shown by Stewart et al. (2021). Starting in 2014, however, organic fluid milk sales growth began to flatten. Nevertheless, the share of total fluid milk sales that is certified organic has

continued to grow, from 2.9 percent in 2009 to 6.6 percent in 2022.[4] The number of organic dairy farms with milk sales has also increased, rising from 2,004 in 2008 to 3,100 in 2019, before dropping to 2,478 in 2021 (figure 4).[5] Considering milk cow inventories and farm numbers, the average organic dairy farm size in 2008 was 109 cows, increasing to 142 cows in 2021.

Figure 1
Inventory of U.S. certified organic milk cows and percentage of total U.S. milk-cow inventory that was certified organic, 1992–2021



USDA, ERS = USDA, Economic Research Service. USDA, NASS = USDA, National Agricultural Statistics Service.

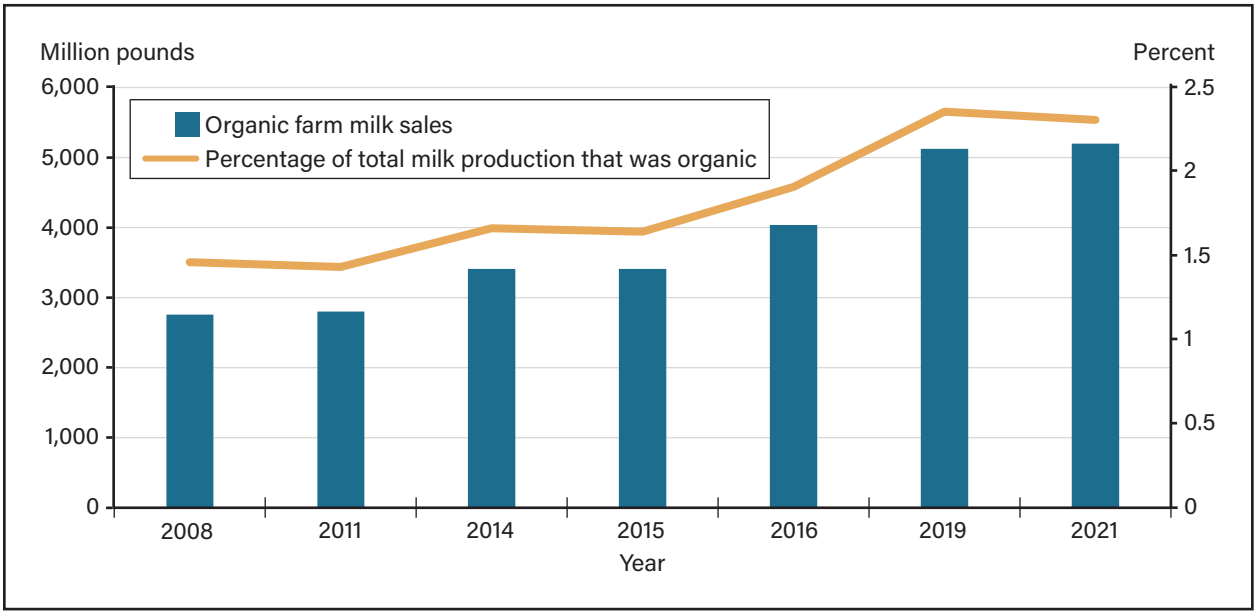
Note: Total inventories of U.S. milk cows from which percentages of certified organic inventories are derived are January 1 inventories from USDA, NASS' *Cattle* report. USDA, ERS' 1992–2010 *Organic Production Data* show total cows certified during the year. USDA, NASS' organic producer survey data show the peak inventory of cows during the year.

Source: USDA, ERS 1992–2010 *Organic Production Data* and USDA, NASS 2011 Certified Organic Production Survey, 2014 and 2019 Organic Survey, and 2015, 2016, and 2021 Certified Organic Survey.

[4] According to USDA, AMS's February 2022 Estimated Fluid Milk Products Sales Report, 6.5 percent of the U.S. total fluid milk sales were organic. Data from USDA, NASS' Milk Production, Disposition, and Income, 2021 Summary show only 2.3 percent of farm milk sales were organic in 2021. These statistics together show a higher percentage of organic milk than conventional milk is sold as fluid milk, as opposed to manufactured dairy products. For more information about beverage milk as the most popular product in the organic dairy sector, see Carlson et al. (2023).

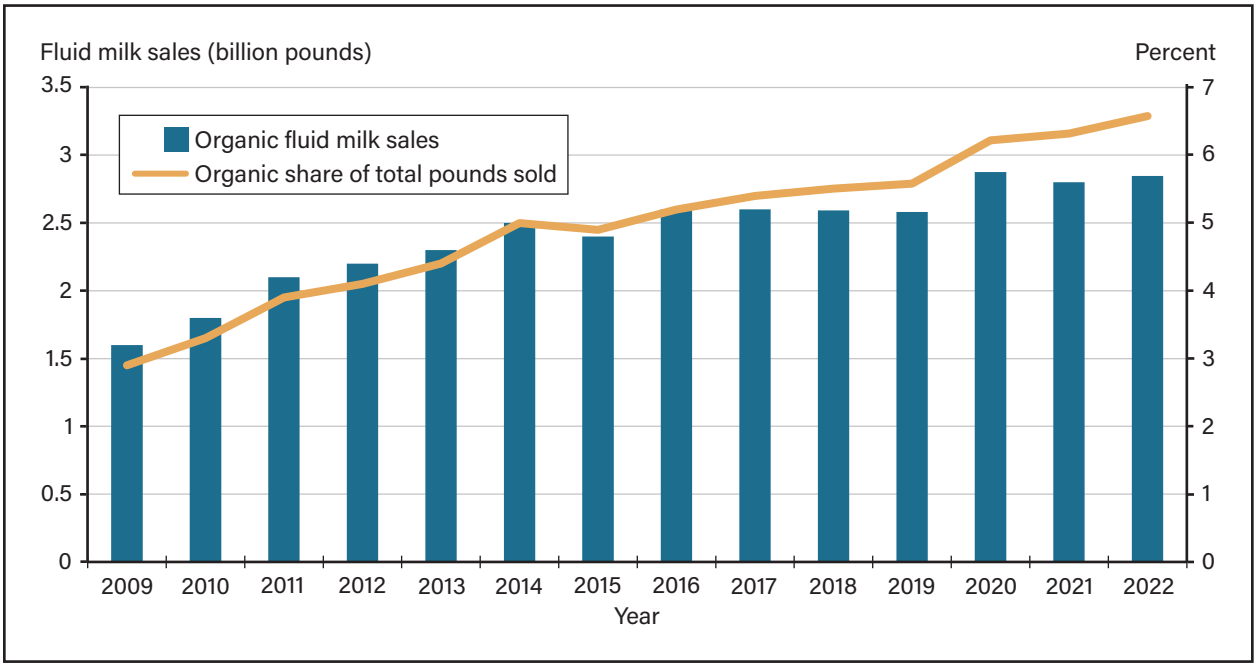
[5] The drop in organic dairy farm numbers from 2019 to 2021 occurred across multiple U.S. regions. States with 80 or more organic dairies in 2019 (in which organic dairy farm numbers decreased by at least one-third) included California, Iowa, Maine, and Michigan. The decline in farm numbers was accompanied by a slight increase in organic milk production.

Figure 2
U.S. organic farm milk sales and percentage of total farm milk sales that were organic, 2008–21



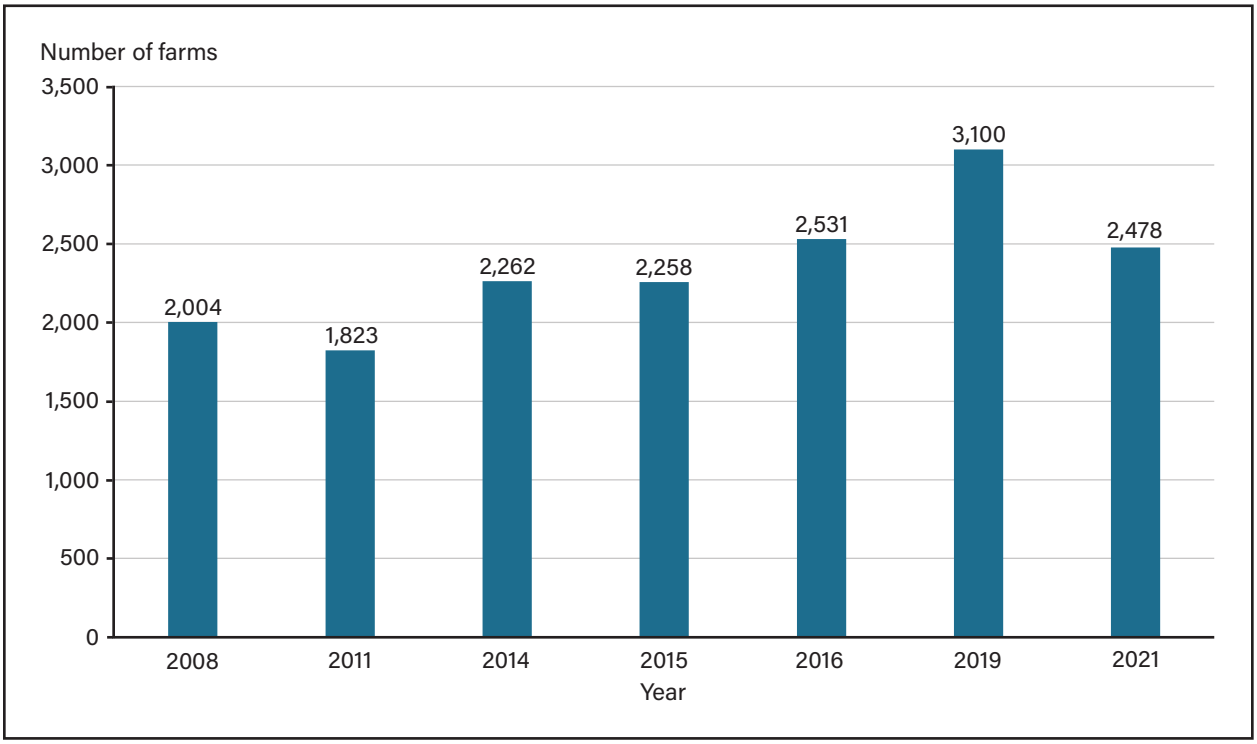
Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service 2008 Organic Production Survey, 2011 Certified Organic Production Survey, 2014 and 2019 Organic Survey, and 2015, 2016, and 2021 Certified Organic Survey, and *Milk Production, Disposition, and Income* report data.

Figure 3
Quantity of organic fluid milk sold and share of total fluid milk sold, 2009–22



Source: USDA, Economic Research Service using USDA, Agricultural Marketing Service Federal Milk Marketing Order statistics and *Estimated Fluid Milk Products Sales Reports* data.

Figure 4
Numbers of certified organic dairy farms in the United States, 2008–21



Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service 2008 Organic Production Survey, 2011 Certified Organic Production Survey, 2014 and 2019 Organic Survey, and 2015, 2016, and 2021 Certified Organic Survey.

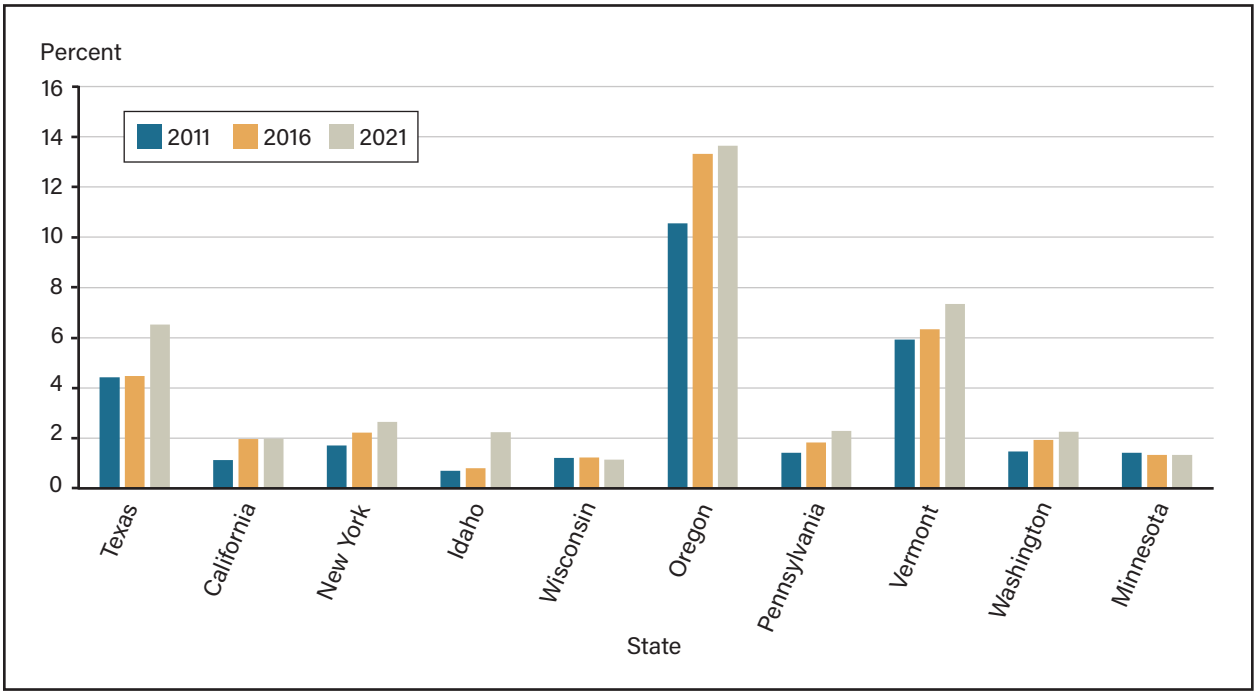
Some notable changes in organic milk sales by State occurred from 2011 to 2021 (table 1), including that Texas overtook California as the top State in organic milk sales, Idaho climbed significantly in organic milk sales, and New Mexico entered the top 10 States in organic milk sales. Farms in Texas, Idaho, and New Mexico were relatively large compared with those in many of the other States, with only 13, 21, and 5 farms, respectively, producing organic milk in 2021. None of these States were among the top 10 in numbers of organic dairy farms in 2021 (table 1), nor did they report organic milk cow inventories in 2000. In recent years, organic dairies in California have faced consequences from drought conditions, including feed shortages and corresponding increases in feed costs.[6] Indiana, Iowa, Maine, and Ohio have been among the top 10 organic dairy States in terms of the number of organic farms, but these States are not consistently among the top 10 organic dairy States in the volume of certified organic milk sold. In some cases, States that are geographically close to one another have experienced different trends. For example, between 2011 and 2021, farm numbers in New York and Pennsylvania increased, while farm numbers decreased in Vermont.

States differ in their percentages of total milk sales that are organic (figure 5). Among the 12 States that have been ranked in the top 10 in sales in at least 1 of the years, 2011, 2016, and 2021—Oregon has consistently had the highest percentage of milk sales that have been organic, increasing from 10.6 percent in 2011 to 13.6 percent in 2021. Vermont and Texas have also had relatively high percentages of milk production that have been organic. Vermont increased from 5.9 percent in 2011 to 7.4 percent in 2021, and Texas increased from 4.4 percent in 2011 to 6.5 percent in 2021.

[6] In 2023, the USDA Farm Service Agency (FSA) announced the Organic Dairy Marketing Assistance Program, a one-time payment to assist with marketing costs. The program targeted organic dairy operations to combat recent input and transportation cost increases, market volatility, and unstable feed supply. Newman (2021) discussed challenges California dairy farmers have faced with drought.

Figure 5

Percentage of milk sales that were organic, States that were in the top 10 in organic milk sales during 2011, 2016, and/or 2021



Note: Certified organic milk sales are from USDA, National Agricultural Statistics Service (NASS) Certified Organic Survey (2016, 2021) and USDA, NASS Certified Organic Production Survey (2011). Total milk sales, from which percentages of sales that are certified organic were derived, are from the USDA, NASS Milk Production, Disposition, and Income report. New Mexico and Ohio were also in the top 10 in organic milk sales in 2021 and 2016, respectively, but disclosure concerns were found in reporting the percentage of milk sales that were organic in 1 or more of the years.

Source: USDA, Economic Research Service using USDA, NASS Certified Organic Survey and USDA, NASS Certified Organic Production Survey, and USDA, NASS Milk Production, Disposition, and Income report.

Certified organic milk cow inventories in the top five States producing organic milk in 2021, which had 54 percent of the combined U.S. organic milk cow inventory, grew significantly during selected years from 2001 to 2021 (figure 6). The recent growth in organic milk cow inventory of farms in Idaho and Texas is particularly noteworthy, with Texas overtaking New York and Wisconsin. Meanwhile, the number of operations with organic milk cows in Wisconsin fell by 10 percent between 2016 and 2021.

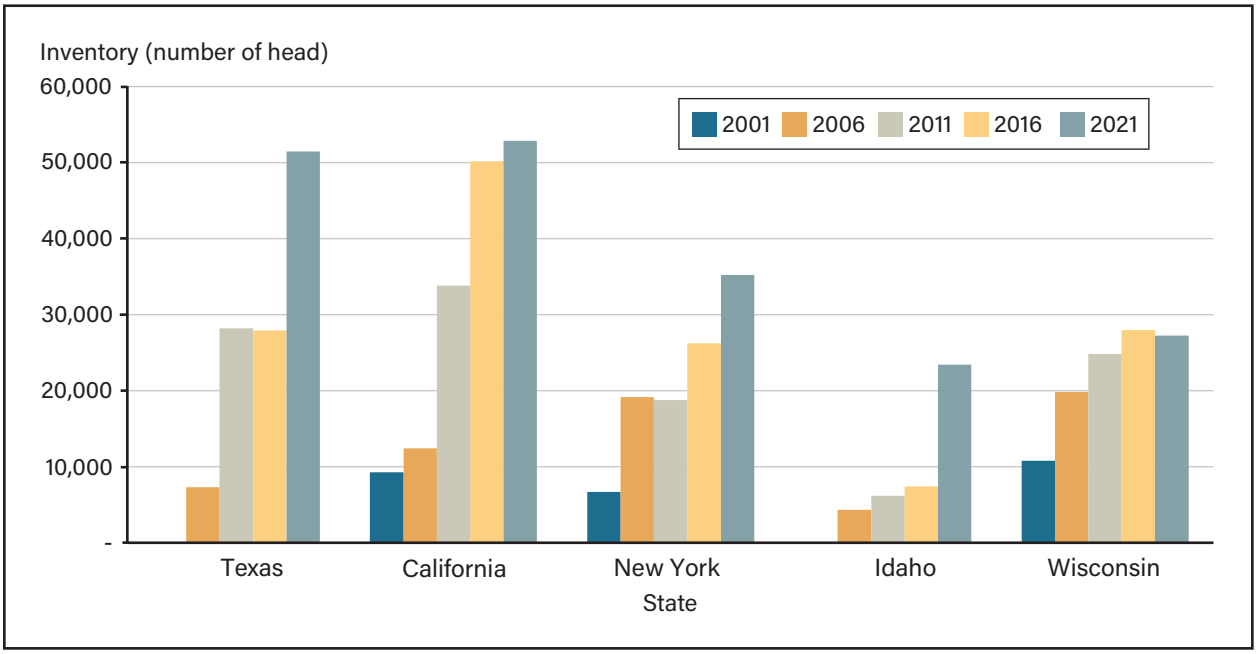
Table 1

Top 10 U.S. States in certified organic milk production by quantity sold and by number of farms, ranked, 2011, 2016, and 2021.

States ranked by certified organic milk sales					
2011		2016		2021	
State	Milk sales (million pounds)	State	Milk sales (million pounds)	State	Milk sales (million pounds)
1. California	469.1	1. California	795.8	1. Texas	1,015.2
2. Texas	423.6	2. Texas	481.4	2. California	827.2
3. Wisconsin	314.0	3. Wisconsin	370.6	3. New York	409.0
4. Oregon	259.2	4. Oregon	342.5	4. Idaho	367.8
5. New York	218.6	5. New York	327.4	5. Wisconsin	359.8
6. Vermont	149.6	6. Pennsylvania	196.6	6. Oregon	354.7
7. Pennsylvania	148.7	7. Vermont	171.5	7. New Mexico	235.2
8. Minnesota	124.9	8. Washington	128.7	8. Pennsylvania	230.2
9. Idaho	93.9	9. Minnesota	127.8	9. Vermont	187.5
10. Washington	90.8	10. Ohio	119.3	10. Washington	146.2
Total sales, top 10 States	2,292.4	Total sales, top 10 States	3,061.6	Total sales, top 10 States	4,132.8
Total U.S. sales	2,797.8	Total U.S. sales	4,035.0	Total U.S. sales	5,196.4
States ranked by numbers of certified organic dairy farms					
2011		2016		2021	
State	Number of farms	State	Number of farms	State	Number of farms
1. Wisconsin	397	1. New York	471	1. New York	509
2. Pennsylvania	236	2. Wisconsin	453	2. Wisconsin	407
3. New York	235	3. Pennsylvania	300	3. Pennsylvania	353
4. Vermont	180	4. Indiana	225	4. Ohio	216
5. Ohio	135	5. Ohio	212	5. Indiana	205
6. Minnesota	114	6. Vermont	172	6. Vermont	147
7. Indiana	81	7. Minnesota	108	7. Minnesota	104
8. Iowa	78	8. California	104	8. California	97
9. California	72	9. Iowa	74	9. Maine	58
10. Maine	50	10. Michigan	70	10. Iowa	56
Total farms, top 10 States	1,578	Total farms, top 10 States	2,189	Total farms, top 10 States	2,152
Total U.S. farms	1,823	Total U.S. farms	2,531	Total U.S. farms	2,478

Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service 2011 Certified Organic Production Survey and 2016 and 2021 Certified Organic Survey.

Figure 6
Certified organic milk cow inventories, top five States producing certified organic milk in 2021, United States, 2001, 2006, 2011, 2016, and 2021



Note: For 2001, USDA, Economic Research Service's Organic Production Data show 40 cows in inventory in Idaho and do not report any cows in inventory in Texas.

Source: USDA, Economic Research Service using 2001 and 2006 Organic Production Data; and USDA, National Agricultural Statistics Service 2011 Certified Organic Production Survey and 2016 and 2021 Certified Organic Survey data.

Changes in U.S. Certified Organic Dairy Farm Structure and Production Practices

Certified organic milk sales and dairy farm numbers have increased over the past two decades. Organic production numbers by State indicate the emergence of large organic dairy farms in some regions. However, the dairy ARMS version does not fully capture many of these changes in organic dairy farm structure. ARMS data show that the average number of milk cows per farm on organic operations surveyed has ranged from 77 in 2010 to 83 in 2016 and back to 77 in 2021 (table 2). Yet, according to the USDA, NASS' Certified Organic Survey, percentage increases in organic dairy cow inventories have exceeded increases in organic dairy farm numbers over the past 15 years, which indicates that large organic dairy farms are underrepresented in recent ARMS dairy data. For example, no organic dairy farms from Texas are included in the 2016 or 2021 ARMS, though Texas had the highest organic milk sales, with only 13 operations in 2021. This potential underrepresentation of very large organic dairy farms should be considered in examining 2005–21 ARMS organic dairy data. For that reason, the results derived from ARMS data for this study are conditional on the States that organic dairy farms were included in the sample and not necessarily representative of the entire organic dairy industry.[7] The ARMS dairy survey is, nonetheless, the only USDA survey from which detailed farm financial and structural characteristics can be derived for organic dairy farms.

[7] ARMS includes weights for each observation that allow for expansion of the sample to represent the total production of organic milk for the targeted States that produce at least 90 percent of organic dairy production. In a case where there are no observations for a major State (such as Texas), the weights expand to the production of organic milk in the targeted States, less the production of the State with no observations.

Table 2 provides information on organic dairy farm size, diversification, and farmer demographics. Dairy farms defined as organic in the ARMS dairy data are farms that indicated they produced only organic milk during the survey year. Organic farms in the ARMS data that were transitioning to organic and/or also sold nonorganic milk are excluded from the analysis.[8] Pounds of milk sold annually per cow trended upward from 13,220 in 2005 to 14,824 in 2021 according to ARMS respondents,[9] and the percentage of farms producing hay fell by 22 percentage points. Although the share of farms with fewer than 50 cows increased and the share of farms with 50–99 cows decreased, the percentage point changes are 8 percent or less over the 17-year period. Aside from changes in farm size, farm structure and productivity measures vary from year to year without obvious trends. Similarly, response averages for the use of selected technologies, management practices, and production systems[10] show little change from 2005 to 2021. Though results generally show consistent responses, farm structural changes that may be associated with increased farm size (such as increased farm specialization or technology adoption) may not be fully represented in the ARMS data, particularly since large Texas organic dairy operations are not represented in the data.

Table 2
Measures of farm structure, productivity, and adoption of technologies, management practices, and production systems for U.S. certified organic dairy farms, 2005, 2010, 2016, and 2021

Item	2005	2010	2016	2021
Number of farms in sample	325	564	381	217
Farm structure, productivity, and farmer demographic measures				
Milk cows, mean (number of head)	81	77	83	77
Acres operated, mean (acres)	336	350	345	271
Acres owned, mean (acres)	215	220	226	182
Pounds of milk sold per cow, mean (pounds)	13,220	13,541	14,214	14,824
Farms with less than 50 cows (percent)	45	49	50	52
Farms with 50–99 cows (percent)	41	34	33	33
Farms with more than or equal to 100 cows (percent)	13	16	17	15
Value of production from dairy (percent)	86	86	91	89
Farms producing corn (percent)	52	64	68	53
Farms producing hay (percent)	92	86	80	70
Debt-asset ratio, mean	0.14	0.16	0.18	0.13
Operator age, mean (age)	49	49	50	49

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[8] Some operations sell both organic and conventional milk, but their inclusion in the estimates as organic or conventional would bias the estimates.

[9] Direct comparisons of milk production per cow cannot be made with other USDA, NASS and USDA, ERS data sources, since full datasets with common years do not exist for either. Calculations using 2021 USDA, NASS organic survey data suggested that organic dairy cows yielded 14,751 pounds per cow, as opposed to the ARMS estimate of 14,824 pounds per cow. Similarly, for 2016, the USDA, NASS organic survey measure was 14,461 pounds per cow, as opposed to the ARMS estimate of 14,214 pounds per cow. The first year for which USDA, NASS organic survey data were available was 2008, yielding calculated productivity of 12,588 pounds per cow for 2008, which was lower than ARMS 2005 and 2010 averages of 13,220 pounds and 13,541 pounds per cow, respectively. A comparison of increased productivity using ARMS from 2005 to 2021 indicated a 12-percent increase in pounds of milk per cow, while a comparison of milk per cow for all U.S. dairy farms indicated an increase from 19,550 pounds to 23,949 pounds per cow, a 23-percent increase. However, if USDA, NASS organic survey data are compared for 2008 and 2021, an increase of 17 percent is found, which is equal to the percentage increase for all U.S. dairy farms for those years. Though ARMS data suggested conventional dairy farm milk produced per cow may have increased faster than for organic farms, USDA, NASS organic survey and Quickstats data do not suggest that to be the case.

[10] Several categories of technologies, management practices, and production systems were examined. Artificial insemination allows for the use of semen from bulls of superior genetics to be used in breeding cows. Embryo transplants allow embryos of superior genetics to be implanted in cows of generally lower genetic value. Sexed semen allows for changing the percentage of offspring that are male versus female. Individual cow production records refer to keeping production records on an individual cow basis. Automatic take-offs refer to sensors on the milking machine that are used to determine the end of milk flow, allowing the milking machine to shut off automatically. Some producers hire nutritionists to design and purchase feeds for their operations. The use of a milking parlor involves cows entering stalls for milking, as opposed to stanchion or tie-stall barns, which typically utilize around-the-barn pipeline or bucket milker systems.

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Item	2005	2010	2016	2021
Use of selected technologies, management practices, and production systems (percent using)				
Artificial insemination, embryo transplant, or sexed semen	73	63	70	72
Individual cow production records (percent using)	62	61	63	52
Automatic take-offs	23	21	NA	25
Nutritionist to design feed ration	45	45	NA	43
Milking parlor	41	45	43	50
Operations using less than 50 percent of forage ration from pasture during grazing season	36	39	52	45
Operations using 50–74 percent of forage ration from pasture during grazing season	33	35	25	33
Operations using 75–100 percent of forage ration from pasture during grazing season	32	26	22	22

NA = not available.

Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2005, 2010, 2016, and 2021 Agricultural Resource Management Survey (ARMS) dairy data.

Certified Organic Dairy Costs and Returns, 2005 to 2021

Costs and returns estimates for organic milk production are available from the USDA, ERS Commodity Costs and Returns Data for survey years 2005, 2010, 2016, and 2021 (table 3). For more information about how these estimates are derived, see the box "Estimation of Dairy Costs and Returns." The gross value of 100 pounds of milk sold (i.e., the price received for milk by the surveyed producers) ranged from $21.88 in 2005 to $36.18 in 2016. For 2021, the ARMS survey price declined to $29.56.[11] Organic dairy operations have historically relied on price premiums for organic milk products to cover higher production costs compared with conventional dairies production costs, often using marketing contracts to secure the price of raw milk[12] from processors (Hadachek et al., 2022).[13] Other components of the production's gross value of production make up smaller proportions of dairy revenue. The value of cattle sold ranged from $1.41 to $1.78 per 100 pounds of milk sold. The fertilizer value of manure produced on the farm remained at approximately $1.00 per 100 pounds of milk sold for the 2005–21 period. Primarily driven by changes in organic milk prices, the total value of production on certified organic dairy farms (i.e., milk and cattle sales, plus fertilizer value of manure) ranged from $24.35 in 2005 to $38.76 per 100 pounds of milk sold in 2016.

[11] In comparison, averaging monthly farm-level organic milk prices reported by Argus Media during 2021 yielded an average price of $28.75 per 100 pounds. USDA, NASS' Agricultural Prices reported the average annual U.S. all-milk prices per 100 pounds for 2005, 2010, 2016, and 2021 were $15.10, $16.30, $16.30, and $18.60, respectively.

[12] Raw milk is any milk (conventional or organic) in its raw form. Processors purchase raw milk as an input from dairy producers and treat it (i.e. pasteurization or heating) to eliminate bacteria prior to selling it to consumers.

[13] Contract use by organic dairy farms has allowed for securing price premiums for milk. According to Hadachek et al. (2022), contracts generally range between 6 months and 3 years, with a fixed price or a price pegged to Class III Federal Milk Marketing Order prices, plus a premium for organic status.

Table 3

Costs and returns associated with producing 100 pounds of certified organic milk on U.S. dairy farms, 2005, 2010, 2016, and 2021

Item	2005	2010	2016	2021
U.S. dollars				
Gross value of production				
Gross value of milk sold	21.88	26.59	36.18	29.56
Cattle	1.78	1.41	1.78	1.70
Other income	0.69	1.11	0.81	0.87
Total value of production	24.35	29.10	38.76	32.13
Operating costs				
Feed				
Purchased feed	6.55	7.08	7.81	9.58
Homegrown feed	5.57	7.36	7.05	6.28
Grazed feed	0.67	0.80	0.91	0.49
Total feed cost	12.78	15.25	15.77	16.35
Veterinary and medicine	0.62	0.68	0.56	0.52
Bedding and litter	0.33	0.59	0.43	0.42
Marketing	0.25	0.25	0.31	0.09
Custom services	0.41	0.50	0.65	0.67
Fuel, lube, and electricity	0.75	1.20	1.05	1.13
Repairs	0.91	1.33	1.82	1.32
Other operating costs	0.10	0.12	0.15	0.18
Interest on operating capital	0.27	0.02	0.05	0.01
Total operating costs	16.43	19.93	20.78	20.69
Allocated overhead				
Hired labor	2.19	2.60	2.83	1.93
Opportunity cost of unpaid labor	5.85	6.65	7.11	7.54
Capital recovery	4.73	6.71	4.41	6.92
Opportunity cost of land	0.10	0.10	0.15	0.13
Taxes and insurance	0.31	0.37	0.44	0.33
General farm overhead	0.93	1.17	1.68	1.09
Allocated overhead costs	14.11	17.60	16.62	17.92
Total costs	30.54	37.53	37.40	38.61
Value of production, less feed costs	11.57	13.86	23.00	15.78
Value of production, less operating costs	7.92	9.18	17.98	11.44
Value of production, less total costs	-6.19	-8.43	1.37	-6.48

Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2005, 2010, 2016, and 2021 Agricultural Resource Management Survey (ARMS) dairy data.

Estimation of Dairy Costs and Returns

Costs and returns associated with milk production are derived from USDA's Agricultural Resource Management Survey (ARMS) dairy surveys. The production value of dairy operations includes the value of milk sold; cattle sales (e.g., cull cows, heifers, bulls, and calves); the value of manure, which is priced according to its estimated fertilizer value; and returns from renting space to other dairy operations. ARMS asks producers to provide the following operating costs (which are mostly variable costs) for their dairy operations: purchased feeds; veterinary and medicine; bedding and litter; marketing; custom services; fuel, lube, and electricity; repairs; and costs for organic dairy certification. Other items include homegrown feed costs (which are determined as the market value of all homegrown feeds harvested on the farm and fed to dairy cattle) and grazed feed costs (which are determined as the rental value of land used for grazing dairy cattle). The interest on operating capital represents the opportunity costs associated with operating expenses using a short-term interest rate.

Allocated overhead expenses associated with the dairy operation include the following:

- The hired labor cost is determined by asking the producer how much was spent for hired labor and their associated benefits for the dairy operation.
- Unpaid labor is the opportunity cost associated with labor used in the dairy enterprise that is unpaid (typically family labor), determined by summing the reported hours of unpaid labor and multiplying by the average off-farm wages earned by farm operators.
- Capital recovery cost is a measure of the ownership cost associated with buildings, equipment, and breeding animals.
- The opportunity cost of land is the rental rate of land used for the dairy operation, not including land for grazing or feed production, since those costs are captured in the homegrown feed and grazed feed cost categories.

Taxes, insurance, and general overhead expenses are determined by asking the producer how much was spent for these items for the whole farm and then allocating those expenses to the dairy enterprise according to the ratio of the gross margin for the dairy enterprise relative to the gross margin for the whole farm.

Three measures of profitability are particularly useful for assessing the returns less costs for dairy farms: (1) the value of production less feed costs; (2) the value of production less operating costs; and (3) the value of production less total costs. For more information on dairy costs and returns estimates, see USDA, Economic Research Service's (ERS) Commodity Costs and Returns Data on the USDA, ERS website.

As with conventional milk production, feed costs make up a substantial component of organic dairy producers' operating costs. Less than 1 percent of the total U.S. corn and soybean acreage is devoted to organic corn and soybean production (Raszap Skorbiansky et al., 2021), which has led to a relatively large share of organic corn and soybeans being imported. In recent years, the combination of low domestic acreage and supply chain disruptions have led to feed shortages and increased feed costs for organic dairy operations. Total nominal feed costs per 100 pounds of milk sold averaged $12.78 in 2005 and $16.35 in 2021. Feed costs accounted for approximately 41 percent to 42 percent of total costs in each of the ARMS dairy survey years analyzed (2005, 2010, 2016, and 2021). The ratio of purchased-to-homegrown feed costs per 100 pounds of milk sold has fluctuated over the 4 ARMS dairy survey years (2005, 2010, 2016, and 2021), ranging from 0.96 in 2010 to 1.53 in 2021. The relatively high 2021 ratio can be partially explained by the relatively high feed grain prices compared with forage prices that year. Dairy producers have tended to

purchase higher shares of feed grains than silage and hay (excluding alfalfa) (Gillespie, 2023). Grazed feed expenses, which reflect reported pasture usage and pasture rental rates, increased through 2016 and declined in 2021. The decline in the grazed feed expenses for 2021 was primarily the result of lower reported pasture rental rates among organic dairy farms in ARMS. Changes in the remaining operating costs generally did not show obvious trends and reflected input price fluctuations and changes in input usage.

On average, unpaid labor accounted for a greater portion of total labor cost than paid labor for each of the 4 years analyzed. The relatively high share of unpaid labor contrasted with the entire ARMS dairy sample (as reported in the USDA, ERS Commodity Costs and Returns Data (2023)), wherein paid labor costs have exceeded unpaid labor costs since 2016. This difference can be partially explained by the smaller average sizes of organic dairy farms relative to conventional dairy farms,[14] as larger conventional farms depend more heavily on paid labor since most families cannot provide all the labor required on a large farm. If, however, large organic dairy farms have been underrepresented in ARMS, the ratio of unpaid to total labor in the 2021 sample may exceed the actual population average.

Overall, the total costs (not adjusted for inflation) associated with producing 100 pounds of organic milk increased during 2005–21, from $30.54 to $38.61. The value of production less total costs per 100 pounds of milk sold was negative for every survey year except 2016, with the lowest value being –$8.43 in 2010 and the highest $1.37 in 2016. The positive value of production less total costs in 2016 resulted primarily from higher organic milk prices, averaging $36.18 per 100 pounds that year. Note that the gross value of production does not include government payments, and organic dairy producers are eligible for the Dairy Margin Coverage (USDA, Farm Service Agency (FSA), 2022), Dairy Revenue Protection (USDA, Risk Management Agency (RMA), 2019), and Livestock Gross Margin Insurance for Dairy Cattle programs (USDA, RMA, 2022).[15] Examining the 4 ARMS years for the 2005–21 period, the organic dairy value of production covered feed costs and total operating costs but not always total costs. These costs include opportunity costs associated with labor, land, and machinery and equipment ownership. The profitability of organic milk production varies from year to year depending upon production conditions, milk prices, and input prices.

Perceptions of the Most Difficult Aspects of Producing Certified Organic Milk

For the ARMS dairy surveys conducted in 2005, 2010, 2016, and 2021, organic dairy respondents were asked, "Of the following, what do you consider to be the most difficult aspect of producing certified organic milk?" Specifically for the 2016 and 2021 surveys, there were nine response options, including (1) raising grains or forage; (2) pasture management; (3) finding grains or forage; (4) finding feed supplements; (5) finding replacement heifers; (6) certification and compliance costs; (7) certification paperwork requirements; (8) maintaining animal health; and (9) higher cost of production. Respondents were asked to choose only one. For the 2010 survey, the raising grains or forage and pasture management options were replaced by an "other" option for a total of eight response options. For the 2005 survey, the options were the same as 2010, except that certification and compliance costs and certification paperwork requirements were combined into one option (i.e., certification paperwork and compliance costs) for a total of seven response options. Table 4 presents percentages of organic dairy respondents who responded affirmatively to each option for each survey year. For 3 years, one or more of the aspects (i.e., finding grains or forage, finding feed supplements, and finding replacement heifers) had fewer than five responses, so those three aspects were combined into one aspect for reporting.

[14] Average maximum cow inventories for dairy farms in the 2021 ARMS dairy survey were 77 cows for organic farms and 329 cows for conventional (not organic) farms.

[15] These Government programs are not designed specifically for organic milk production.

For the 2010, 2016, and 2021 surveys, respondents responded most frequently that the "certification paperwork requirements" were the most difficult aspect of producing organic milk. Similarly, for the 2005 survey, respondents' most frequently provided responses were certification paperwork and compliance costs. The second-most difficult aspect of organic production in the 2010, 2016, and 2021 survey responses was the higher cost of production. The second-most difficult aspect in 2005 was finding grains or forage, feed supplements, or replacement heifers, but this aspect trended downward in importance over the 4 survey years. However, it is noted that for the 2016 and 2021 surveys, respondents who indicated raising grains and forage were the most difficult aspect might have indicated finding grains and forage as the most difficult aspect in 2005 and 2010, but it was not an option in the 2005 and 2010 surveys. The share of operators responding that maintaining animal health was the most difficult aspect trended downward over the 4 survey years. Overall, downward trends in maintaining animal health, raising grains or forage, and finding grains or forage, feed supplements, or replacement heifers may reflect respondents' greater understanding of preferred production practices and the development of organic input markets as certified organic production expands.

Table 4
Share of certified organic dairy producers providing the listed responses to the question, "What do you consider to be the most difficult aspect of producing certified organic milk?" for 2005, 2010, 2016, and 2021 surveys

Aspect	2005	2010	2016	2021
Observations	325	564	381	217
Raising grains or forage	NA	NA	13.9	6.3
Pasture management	NA	NA	3.0	5.8
Finding grains or forage, feed supplements, or replacement heifers	22.8	7.9	3.6	2.0
Certification and compliance costs	NA	5.2	6.7	4.3
Certification paperwork requirements	NA	58.5	50.2	44.0
Certification paperwork and compliance costs	39.9	NA	NA	NA
Maintaining animal health	13.2	9.3	6.5	3.1
Higher cost of production	16.9	11.8	13.9	29.0
Other or did not report	7.1	7.5	2.0	5.5

NA=Not applicable.

Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2005, 2010, 2016, and 2021 Agricultural Resource Management Survey (ARMS) dairy data.

Certified Organic Milk Production Farm Characteristics by Size of Operation

Previous studies have shown that increases in dairy herd size have cost advantages (MacDonald et al., 2007; MacDonald et al., 2020). Furthermore, farms of different sizes have also been likely to exhibit differences in farm diversification and technology adoption. For 2021, the ARMS dairy data contained sufficient observations to compare these measures across 3 size categories including less than 50 cows, 50–99 cows, and more than or equal to 100 cows, though a 100-cow dairy would not generally be considered a large herd for either conventional or organic production by current standards. The 2016 ARMS had sufficient observations to further divide the greater than or equal to 100 cows category into 100–174 cows and greater than or equal to 175 cows categories. Thus, we also examined the larger 2016 ARMS sample to infer information from larger operations. Herd size categories in this report referred to the largest number of dairy cows milked on the farm at any time during the year. Moreover, 17 percent and 15 percent of organic dairy farms had 100 or more cows during 2016 and 2021, respectively, but these farms produced more than half of the organic milk sold both years (table 5).

Consistent with MacDonald et al. (2020) results for all dairy farms (both organic and conventional), larger organic dairy farms produced more milk per cow during both 2016 and 2021 than smaller organic dairy farms. However, organic milk sold per-cow averages for all size categories were lower than the average milk sold per cow on all dairy farms (both conventional and organic) in the dairy ARMS in 2016 and 2021. These numbers were 22,761 and 23,949 pounds per cow per year, respectively. Higher output for larger dairy farms was likely a result of differences in the use of selected advanced technologies, management practices, and production systems by size. In both years, larger sized operations were generally more likely than smaller operations to adopt advanced reproduction technologies, such as artificial insemination, embryo transplants, and/or sexed semen; the use of a milking parlor; and retention of individual cow records. For 2021, larger sized operations were more likely to utilize automatic takeoffs on their milking machines and use a nutritionist to design feed rations.[16] Automatic takeoff systems remove the milking device from the cow when milk flow decreases to a certain level, allowing for labor savings and lower likelihood of mastitis since the milking device is unlikely to remain on the cow beyond milk flow.

In 2016 and 2021, farm operations with larger herds operated more acreage and owned more land. Larger acreage on farms with more cows can be at least partially attributed to additional land required for grazing, which is a requirement for organic dairy cows. We also found differences in farm diversification by farm size. Smaller percentages of larger operations harvested hay on their operations compared with smaller operations; 82 percent and 85 percent of farms with fewer than 50 cows produced hay in 2021 and 2016, respectively. However, less than half of the farms in categories with at least 100 cows in 2021 (and at least 175 cows in 2016) produced hay. This result is consistent with the USDA, ERS' Milk Cost of Production estimates for all U.S. dairy farms, which have shown increasingly higher portions of total feed costs coming from purchased sources relative to homegrown feed sources as dairy operations become larger.

Certified Organic Milk Production Costs by Size of Operation

We compare costs and returns associated with organic milk production by farm size and with similar-sized conventional dairy farms using the 2016 and 2021 ARMS dairy data (table 6; table 7). Conventional dairy operations were split into size categories comparable to those used for organic operations, except for the largest size categories, for which sufficient observations were not available for further organic dairy size breakouts. We did not find differences in the value of milk production per 100 pounds of milk sold among different organic dairy farm sizes, but as expected, organic dairy farms had higher value of milk production per 100 pounds of milk sold than conventional operations. The value of milk production per 100 pounds sold was higher for organic than conventional dairy farms because of the price premium associated with organic milk.

[16] Nehring et al. (2021) also examined operations that had equal to or greater than 175 cows for 2016. Their results differed somewhat from the results in this report because those operations included farms that produced both certified organic and conventional milk and those that were transitioning to certified organic in the organic category.

Table 5

Farm structure, demographics, and adoption of production practices for U.S. organic dairy farms by size category and year

Item	2016				2021		
	<50 cows (a)	50–99 cows (b)	100–174 cows (c)	≥175 cows (d)	<50 cows (a)	50–99 cows (b)	≥100 cows (c)
Number of farms in sample	157	145	47	32	93	83	41
Percent of farms	50	33	9	8	52	33	15
Percent of milk cows	20	27	14	39	25	28	47
Percent of milk sold	17	26	14	43	21	26	53
Farm structure and farmer demographics							
Milk cows (number of head)	33[bcd]	68[acd]	125[abd]	426[abc]	37[bc]	66[ac]	240[ab]
Acres operated (acres)	169[bcd]	370[acd]	588[ab]	1,100[ab]	162[bc]	267[ac]	652[ab]
Acres owned (acres)	131[bcd]	250[acd]	377[ab]	557[ab]	120[bc]	171[ac]	419[ab]
Milk sold per cow (pounds)	12,537[d]	13,368[d]	14,221	15,657[ab]	12,538[c]	13,477	16,868[a]
Percent of value of production from dairy	88	89	90	93	85	91	91
Percent of farms producing corn	73	65	56	60	60	55	28
Percent of farms producing hay	85[cd]	81[d]	72[ad]	45[abc]	82[c]	63	41[a]
Debt-asset ratio	15[d]	14[d]	19	25[ab]	13	13	13
Operator age (years)	47[bcd]	52[ac]	57[ab]	54[a]	47	48	54
Technologies, management practices, production systems							
Artificial insemination, embryo transplant, or sexed semen	57[bc]	85[a]	79[a]	76	61[b]	79[a]	D
Individual cow production records	52[bcd]	73[a]	73[a]	82[a]	36[b]	72[a]	66
Automatic takeoffs	NA	NA	NA	NA	5[bc]	45[a]	49[a]
Nutritionist to design feed ration	NA	NA	NA	NA	27[c]	52	73[a]
Milking parlor	31[c]	37[c]	86[ab]	D	41[c]	50[c]	82[ab]
Less than 50 percent of forage from pasture during grazing season	42[bcd]	62[ad]	60[ad]	82[abc]	29[bc]	58[a]	75[a]
50–74 percent forage from pasture during grazing season	27	23	25	D	45[b]	20[a]	D
75–100 percent forage from pasture during grazing season	31[bc]	15[a]	15[a]	D	25[b]	21[a]	D

NA = Not applicable. D = Insufficient data for disclosure.

Note: Superscripts refer to results of statistical tests of differences between item means in each column within year category. Tests are expressed at a 90-percent level of confidence. Superscripts denote that the mean reported in a column is significantly statistically different from the mean in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data.

Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2005, 2010, 2016, and 2021 Agricultural Resource Management Survey (ARMS) dairy data.

In 2021, larger organic operations had higher purchased feed costs per 100 pounds of milk sold. In both 2016 and 2021, the operations had lower homegrown feed costs per 100 pounds of milk sold than smaller operations. This finding shows a tendency for dairy farms to substitute homegrown feed with purchased feed as the farms become larger and more specialized in milk production. The cost of grazed feed per 100 pounds of milk sold for organic dairy farms exceeded the cost for conventional farms for all size categories during both the 2016 and 2021 survey years, a finding that has been consistent with the NOP requirement that organic dairy cows receive at least 30 percent of their dry matter intake from pasture during the grazing season. For conventional farms, the cost of grazed feed per 100 pounds of milk sold declined with larger farm sizes in both the 2016 and 2021 survey years. However, organic farm trends did not follow clear patterns along this same line, likely because the same pasture requirement is in place for organic farms of all sizes. Overall, the data have shown that larger scale organic and conventional dairy farms have tended to depend more heavily on purchased rather than homegrown feeds, and smaller farms of both types have tended to depend more heavily on homegrown feeds. Organic dairy farms' total feed costs per 100 pounds of milk sold did not differ in either year by farm size. In addition, organic dairy farm total feed costs exceeded those of conventional dairy farms primarily because of the higher organic feed prices. Total operating costs per 100 pounds of milk sold for organic dairy farms exceeded those of conventional dairy farms for some size categories in 2021 and all size categories in 2016. For both organic and conventional farms in 2016 and 2021, as farm size increased, paid labor costs per 100 pounds of milk sold increased, while unpaid labor costs per 100 pounds of milk sold decreased. As with conventional operations, the greater labor needs associated with larger organic dairy farms require additional labor beyond what the operator and family can provide (McDonald et al., 2007). Except for the organic 50–99 cow category in 2021, capital recovery costs per 100 pounds of milk sold decreased as size increased for both organic and conventional farms in both the 2016 and 2021 survey years, showing that economies of size have been associated with buildings, machinery, and equipment ownership in milk production. The total allocated overhead cost per 100 pounds of milk sold decreased as farm size increased for both organic and conventional farms, further illustrating the economies of size associated with allocated overhead costs.

Figures 7 and 8 show the total cost of organic and conventional milk production per 100 pounds of milk sold by farm size using ARMS dairy data for 2005, 2010, 2016, and 2021. For 2005 and 2021 (figure 7), insufficient organic observations were available to break the greater than or equal to 100 cow size category into additional size categories. However, for 2010 and 2016 survey years, sufficient observations were available for dividing the category into 100–174 and greater than or equal to 175 cow categories. Per unit costs declined for all 4 survey years, except in 2021 for the 50–99 cow organic category. Note also the higher per unit costs of organic production compared with conventional production. These results further show the economies of size associated with both certified organic and conventional milk production.

Table 6

2021 estimates: Cost and returns of producing 100 pounds of milk, U.S. organic and conventional dairy farms, by selected farm size categories

Measure	Certified organic			Conventional			
	<50 cows (a)	50–99 cows (b)	≥100 cows (c)	<50 cows (d)	50–99 cows (e)	100–499 cows (f)	≥500 cows (g)
Number of observations	93	83	41	44	117	249	175
Average number of cows	37	66	240	32	72	209	1,766
Value of milk production (dollars)	28.68^{defg}	28.80^{defg}	30.28^{defg}	17.30^{abceg}	18.74^{abcd}	17.97^{abc}	18.09^{abcd}
Value of production (dollars)	31.83^{defg}	31.40^{defg}	32.60^{defg}	19.37^{abce}	20.71^{abcdg}	19.50^{abc}	19.65^{abce}
Purchased feed costs (dollars)	6.57^{cdg}	7.20^{cdefg}	11.93^{abdef}	4.75^{abcg}	5.49^{bcg}	5.80^{bcg}	8.78^{abdef}
Homegrown feed costs (dollars)	8.95^{cfg}	10.42^{cdefg}	3.22^{abdef}	6.74^{bcg}	7.25^{bcg}	5.79^{abcg}	2.94^{abdef}
Grazed feed costs (dollars)	0.62^{bdefg}	0.43^{adefg}	0.46^{defg}	0.16^{abcfg}	0.08^{abcfg}	0.02^{abcdeg}	0.00^{abcdef}
Total feed costs (dollars)	16.14^{defg}	18.04^{defg}	15.61^{fg}	11.64^{ab}	12.82^{ab}	11.62^{abc}	11.72^{abc}
Total operating costs (dollars)	21.05^{defg}	23.16^{defg}	19.35^{g}	15.56^{ab}	16.40^{ab}	15.24^{ab}	14.46^{abc}
Paid labor costs (dollars)	0.36^{bcfg}	1.20^{acg}	2.90^{abdef}	0.62^{cfg}	0.62^{cfg}	1.80^{acde}	2.11^{abde}
Unpaid labor costs (dollars)	17.96^{bcdefg}	10.55^{acdefg}	1.94^{abdeg}	12.93^{abcefg}	6.61^{abcdfg}	2.04^{abdeg}	0.19^{abcdef}
Capital recovery costs (dollars)	6.96^{bcg}	10.97^{acfg}	4.94^{abeg}	9.41^{g}	7.40^{cg}	6.35^{bg}	2.87^{abcdef}
Total allocated overhead costs (dollars)	26.92^{cefg}	24.87^{cefg}	10.99^{abdeg}	24.89^{cefg}	15.70^{abcdfg}	11.04^{abdeg}	5.77^{abcdef}
Total costs (dollars)	47.97^{cefg}	48.03^{cefg}	30.34^{abg}	40.46^{fg}	32.10^{abfg}	26.28^{abdeg}	20.23^{abcdef}
Return over operating costs (dollars)	10.78^{defg}	8.24	13.25^{defg}	3.81^{ac}	4.31^{ac}	4.26^{ac}	5.19^{ac}
Return over total costs (dollars)	-16.14^{cefg}	-16.62^{cfg}	2.27^{abdef}	-21.09^{cefg}	-11.39^{acdfg}	-6.78^{abcdeg}	-0.59^{abdef}

Note: Superscripts refer to results of statistical tests of differences between item means in each column. Tests are expressed at a 90-percent level of confidence. Lettered superscripts denote that the item mean reported in a column is significantly statistically different from that in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data, as discussed in Dubman (2000).

Source: USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service 2021 ARMS dairy data, Dubman, R.W. (2000), and *Variance estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Surveys* (Report No. AGES 00-01), USDA, ERS.

Table 7

2016 estimates: Cost and returns of producing 100 pounds of milk, U.S. organic and conventional dairy farms, by selected farm size categories

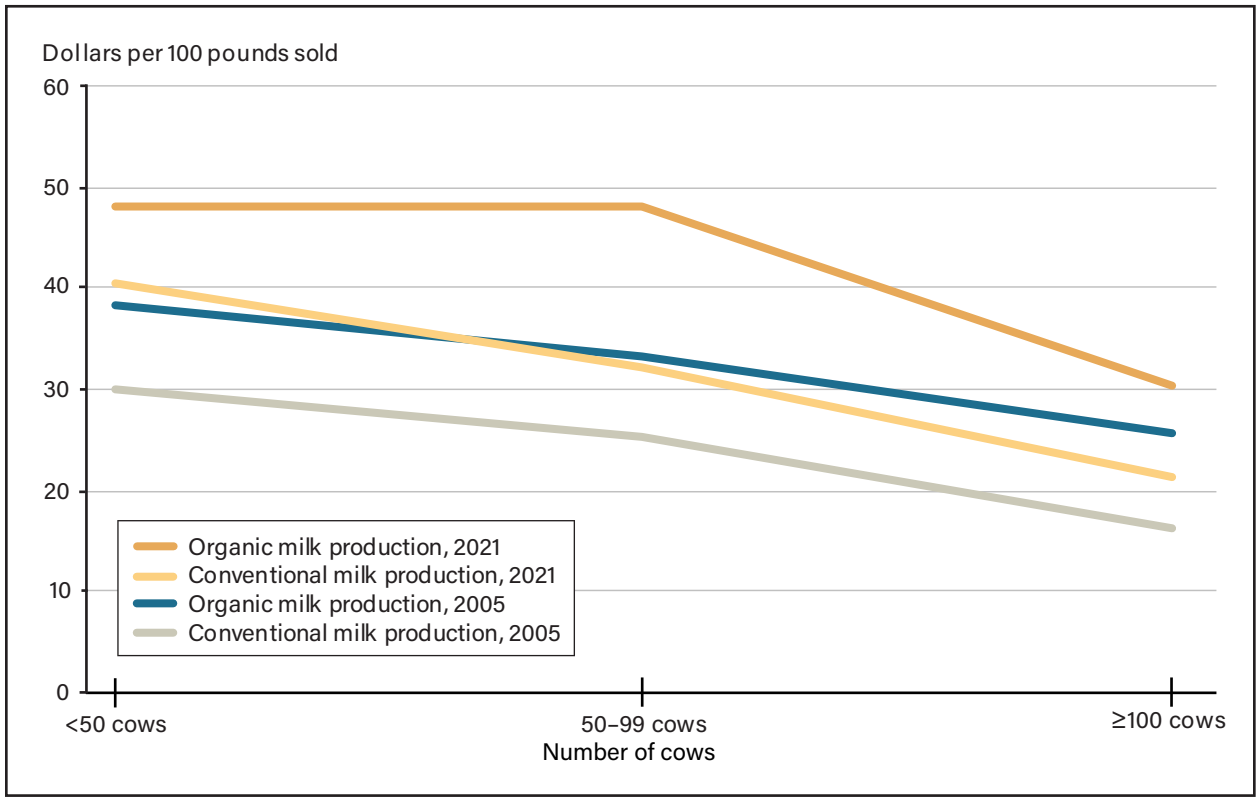
Measure	Certified organic				Conventional				
	<50 cows (a)	50–99 cows (b)	100–174 cows (c)	≥175 cows (d)	<50 cows (e)	50–99 cows (f)	100–174 cows (g)	175–999 cows (h)	≥1,000 cows (i)
Number of observations	157	145	47	32	95	209	225	409	177
Average number of cows	33	68	125	426	35	67	128	395	2,283
Value milk production (dollars)	35.05^{efghi}	35.17^{efghi}	36.70^{efghi}	37.07^{efghi}	16.67^{abcdi}	16.53^{abcdi}	16.43^{abcdi}	16.74^{abcdi}	15.88^{abcdefgh}
Value of production (dollars)	37.79^{efghi}	37.93^{efghi}	38.99^{efghi}	39.59^{efghi}	19.33^{abcdgi}	18.53^{abcd}	18.34^{abcdei}	18.78^{abcdi}	17.83^{abcdegh}
Purchased feed costs (dollars)	6.87^{efg}	6.65^{efg}	7.94^{efg}	8.85	4.36^{abchi}	5.02^{abchi}	4.63^{abchi}	6.13^{efgi}	7.45^{efgh}
Home-grown feed costs (dollars)	9.30^{defghi}	9.21^{defghi}	7.73^{defghi}	4.61^{abchi}	5.14^{abchi}	4.83^{abchi}	4.70^{abchi}	2.76^{abcdefgi}	1.66^{abcdefgh}
Grazed feed costs (dollars)	0.96^{efghi}	0.78^{efghi}	0.75^{efghi}	1.02^{efghi}	0.37^{abcdfghi}	0.14^{abcdehi}	0.09^{abcdei}	0.05^{abcdefi}	0.01^{abcdefgh}
Total feed costs (dollars)	17.13^{efghi}	16.64^{efghi}	16.42^{efghi}	14.48^{ghi}	9.87^{abci}	10.00^{abc}	9.41^{abcd}	8.94^{abcd}	9.12^{abcde}
Total operating costs (dollars)	22.25^{efghi}	22.17^{efghi}	21.27^{efghi}	19.19^{efghi}	14.20^{abcdhi}	14.00^{abcdhi}	13.19^{abcdi}	12.17^{abcdef}	11.57^{abcdefg}
Paid labor costs (dollars)	0.66^{bcdghi}	1.91^{acdefg}	2.88^{abefghi}	4.25^{abefghi}	0.40^{bcdghi}	0.61^{bcdghi}	1.27^{abcdefhi}	2.08^{acdefg}	1.94^{acdefg}
Unpaid labor costs (dollars)	18.22^{bcdefghi}	9.47^{acdefghi}	5.60^{abdefghi}	1.68^{abcefgi}	12.19^{abcdfghi}	7.54^{abcdeghi}	4.06^{abcdefhi}	1.16^{abcefgi}	0.17^{abcdefgh}
Capital recovery costs (dollars)	5.23^{bcdefghi}	4.70^{adfghi}	4.45^{adhi}	3.89^{abcefi}	4.69^{adfghi}	4.47^{abdeghi}	4.19^{abefhi}	3.96^{abcefgi}	3.45^{abcdefgh}
Total allocated overhead costs (dollars)	26.66^{bcdefghi}	18.56^{acdfghi}	14.68^{abdeghi}	12.01^{abcehi}	18.59^{acfghi}	13.82^{abeghi}	10.48^{abcefhi}	7.99^{abcdefgi}	6.06^{abcdefgh}
Total costs (dollars)	48.92^{bcdefghi}	40.72^{acdefghi}	35.95^{abdfghi}	31.20^{abcghi}	32.79^{abfghi}	27.81^{abceghi}	23.67^{abcdefhi}	20.16^{abcdefgi}	17.63^{abcdefgh}
Return over operating costs (dollars)	15.53^{defghi}	15.76^{defghi}	17.72^{efghi}	20.41^{abefghi}	5.12^{abcd}	4.53^{abcdhi}	5.16^{abcdh}	6.61^{abcdfg}	6.26^{abcdf}
Return over total costs (dollars)	-11.13^{bcdghi}	-2.80^{acdefi}	3.04^{abdefgh}	8.40^{abcefghi}	-13.46^{bcdfghi}	-9.29^{bcdeghi}	-5.32^{acdefhi}	-1.38^{acdefgi}	0.20^{abdefgh}

Note: Superscripts refer to results of statistical tests of differences between item means in each column. Tests are expressed at a 90-percent level of confidence. Lettered superscripts denote that the item mean reported in a column is significantly statistically different from that in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data, as discussed in Dubman (2000).

Source: USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service 2021 ARMS dairy data, Dubman, R.W. (2000), and *Variance estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Surveys* (Report No. AGES 00-01), USDA, ERS.

Return-over-operating costs per 100 pounds of milk sold were generally higher for organic than similarly sized conventional dairy farms in both the 2016 and 2021 survey years. Return-over-total costs increased with larger farm sizes for both organic and conventional production systems, reflecting the economies of size associated primarily with allocated overhead costs. Comparing organic with conventional farms of similar sizes, organic farms had higher return-over-total costs for most size categories for both the 2016 and 2021 survey years. Tables 6 and 7 show that the average dairy farm in all size categories covered operating costs in both 2016 and 2021. The average organic dairy farm in the farm size categories (with fewer than 100 cows) did not cover total costs in both the 2016 and 2021 survey years. Figures 9 and 10 show that operating costs were covered by 88–94 percent of organic dairy farms, depending upon size category and year, whereas total costs were covered by 9 percent (50–99 cows in 2021) to 79 percent (equal to or greater than 175 cows in 2016) of organic dairy farms.

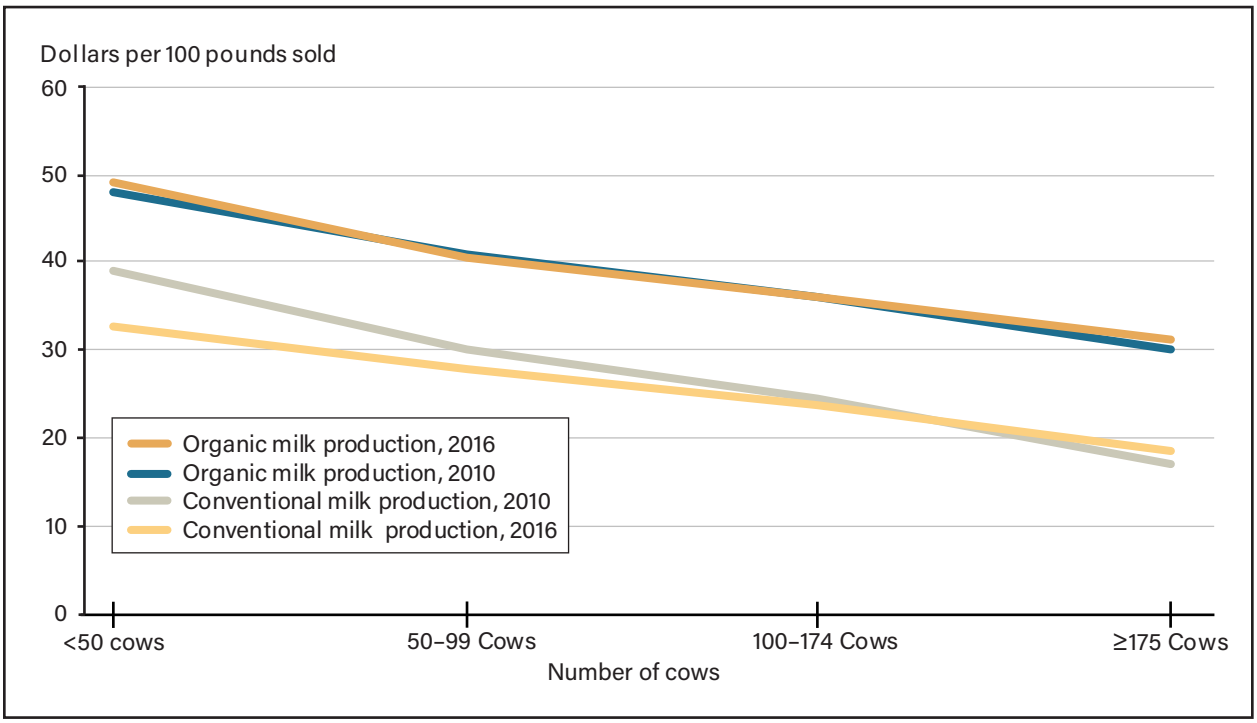
Figure 7
Certified organic and conventional milk production costs per 100 pounds sold by size category, 2005 and 2021



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2005 and 2021 Agricultural Resource Management Survey (ARMS) dairy data.

Figure 8

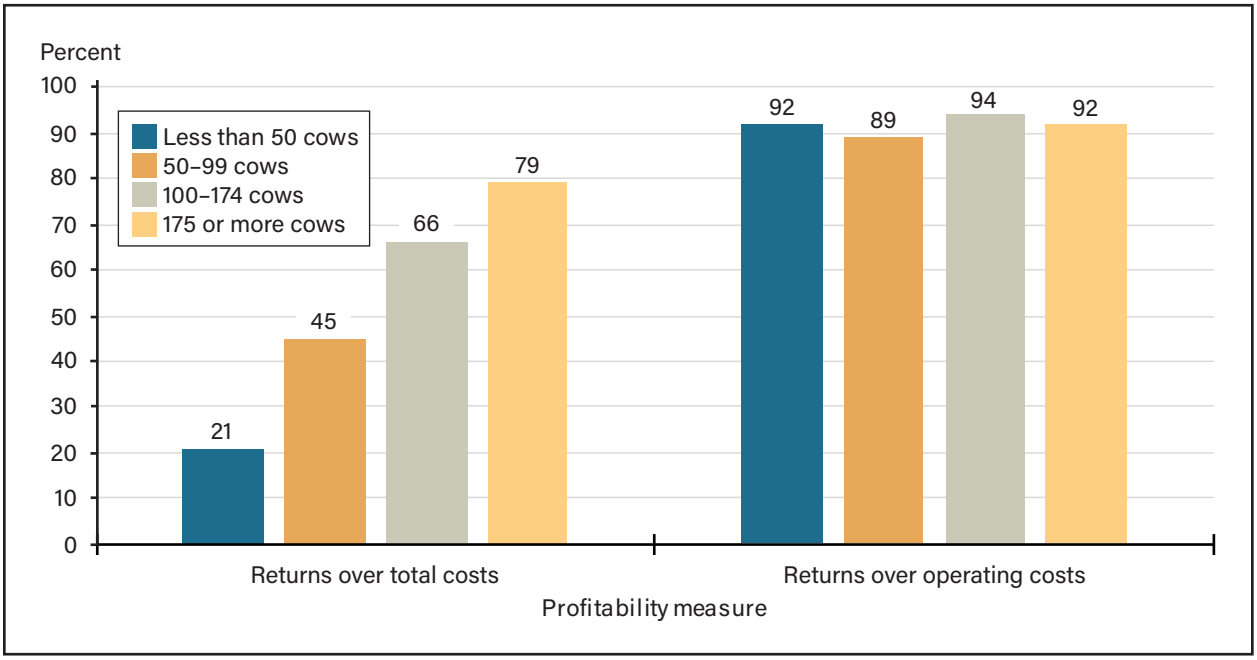
Certified organic and conventional milk production cost per 100 pounds sold by size category, 2010 and 2016



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2010 and 2016 Agricultural Resource Management Survey (ARMS) dairy data.

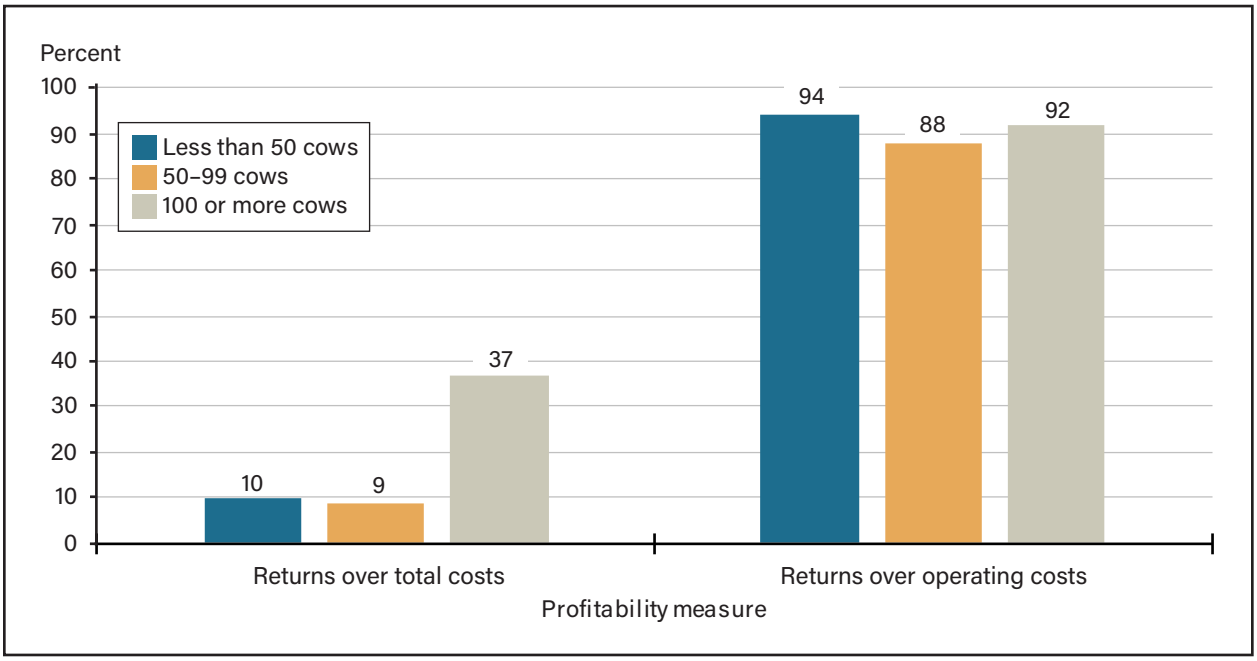
Figure 9

Percent of organic dairy farms with positive returns above total and operating costs, by size, 2016



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2016 Agricultural Resource Management Survey (ARMS) dairy data.

Figure 10
Percent of organic dairy farms with positive returns above total and operating costs, by size, 2021



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service 2021 Agricultural Resource Management Survey (ARMS) dairy data.

Certified Organic Dairy Farm Characteristics by U.S. Region

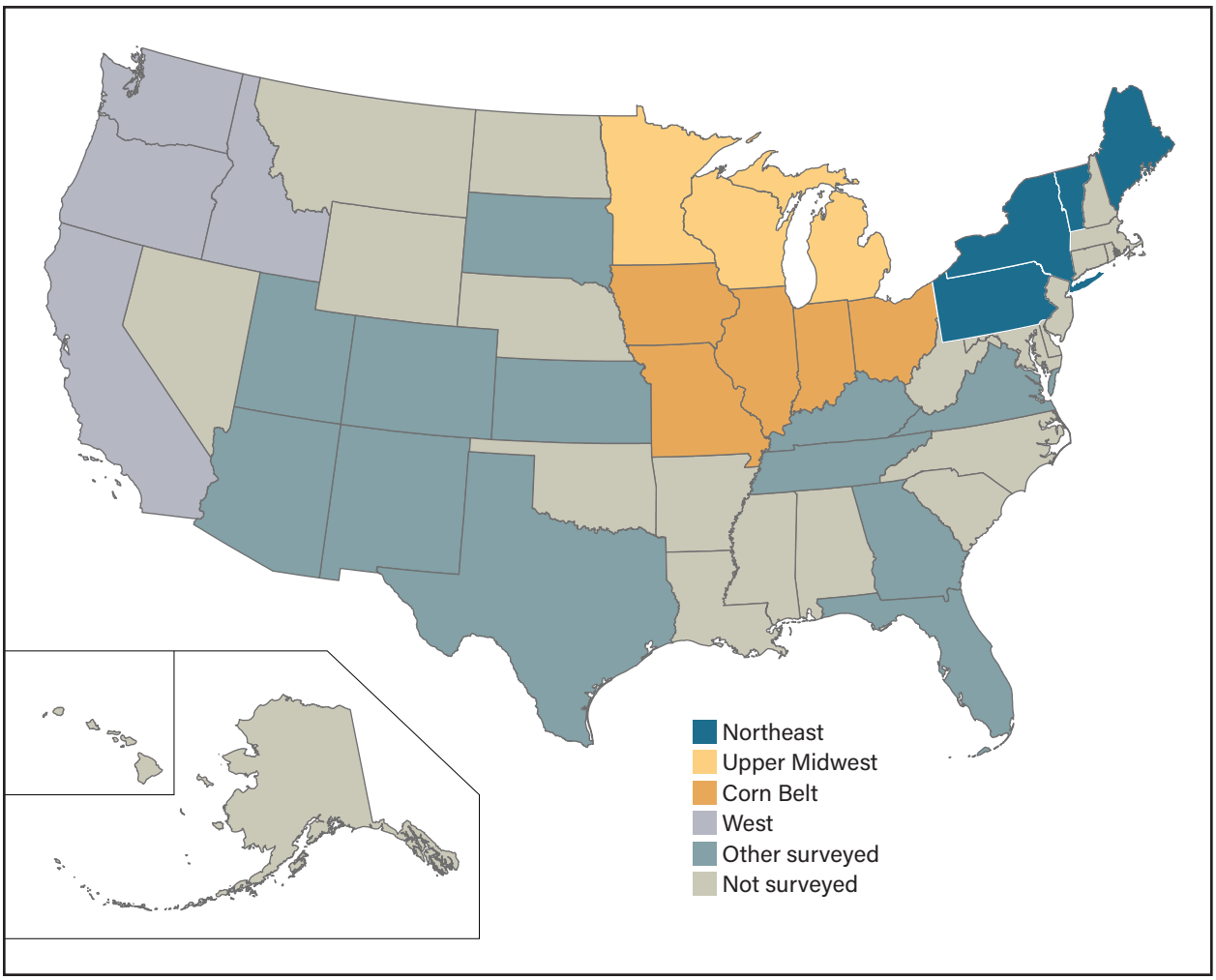
U.S. organic dairy production regions vary in climate, feedstuff availability, and land resources, which have led to geographic differences in farm structure. We examined regional differences for 3 survey years (2010, 2016, and 2021) in organic dairy farms by size, diversification, financial, demographic, and use of technologies, management systems, and production systems. We compared these results with McBride and Greene (2009), who conducted similar analyses using the 2005 ARMS data. The 2021 ARMS dairy data included insufficient observations to separate western U.S. farms into a distinct category, and the 2016 data included a relatively small sample of western farms. The 2010 data included a larger number of observations for the West, so including 2010 data allowed for more extensive consideration of regional differences. To ensure sufficient observations for a comparison of regional organic dairy characteristics in regions with generally similar dairy production characteristics,[17] we developed organic dairy farm regions (shown in figure 11) that could be used for all 3 years. The Northeast includes Maine, New York, Pennsylvania, and Vermont; the Upper Midwest includes Michigan, Minnesota, and Wisconsin; the Corn Belt includes Illinois, Indiana, Iowa, Ohio, and Missouri; the West includes California, Idaho, Oregon, and Washington. During 1 or more years, some organic dairy farms were also surveyed in other regions, but insufficient observations were available to develop separate organic dairy estimates for those regions.[18] Table 8 shows farm numbers and milk cow inventories in each of the regions in 2011 and 2021 using the USDA, NASS' 2011 Certified Organic Production Survey and USDA, NASS' 2021 Certified Organic Survey data. The decreased percentages of U.S. farms and milk cows in the Upper Midwest and corresponding increases in percentages of both measures in "other regions" from 2011 to 2021 were particularly noteworthy.

[17] Similarities within regions generally include similar crop mix, herd size, land characteristics, and climate characteristics. However, there has been a lot of variation within regions. For example, farms in southern California would experience different climate conditions than those in northern Washington.

[18] Surveyed States that were not included in one of the four regions used for regional analysis of organic dairy farms included: Arizona, Colorado, Florida, Georgia, Kansas, Kentucky, New Mexico, South Dakota, Tennessee, Texas, Utah, and Virginia.

Consistent with McBride and Greene (2009) for 2005, the ARMS data showed organic dairy farms in the West had the largest average herd sizes and farmed greater acreages in 2010 and 2016 (table 9). Despite regional herd size differences, the ARMS data did not indicate a clear pattern of regional differences in milk sold per cow across all 4 survey years. Using USDA, NASS 2021 Certified Organic Survey data to calculate regional milk production per cow on the basis of total pounds of organic milk produced and peak cow inventory, the 2021 ranking of pounds of organic milk produced per cow (from highest to lowest) included the West (15,470 pounds); Upper Midwest (12,977 pounds); Northeast (11,930 pounds); and Corn Belt (11,519 pounds). These estimates were lower than the 2021 ARMS regional estimates, but the regional rankings were consistent with those found using the 2010 ARMS data, and the rankings were comparable to those found by McBride and Greene (2009) using the 2005 ARMS data.[19]

Figure 11
Map of certified organic dairy regions used in the analysis, plus other States surveyed in the 2016 and 2021 Agricultural Resource Management Survey dairy version



Source: USDA, Economic Research Service.

[19] McBride and Greene (2009) did not include Corn Belt estimates.

Table 8

Numbers of farms and milk cows in inventory by U.S. dairy farm region, 2011 and 2021

Region	Number of farms	Percent of farms	Number of milk cows	Percent of milk cows
2011				
Corn Belt	318	17	16,031	8
Northeast	714	39	47,901	22
Upper Midwest	562	30	37,413	18
West	168	9	64,647	30
Other regions	86	5	56,208	22
2021				
Corn Belt	507	20	28,113	8
Northeast	1,089	43	73,120	21
Upper Midwest	563	22	40,970	12
West	195	8	109,619	31
Other regions	174	7	100,467	28

Note: "Other regions" includes States that are not included in the Corn Belt, Northeast, Upper Midwest, or West.

Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service 2011 Certified Organic Production Survey data and 2021 Certified Organic Survey data.

Organic dairy farm diversification varied by region as indicated by the percentage of the value of farm production from dairy. Corn Belt and Upper Midwest organic dairy farms generally were more likely to produce corn, and Corn Belt farms were generally more likely to produce hay than farms in most other regions. A variety of factors influence an operator's decision whether to grow feed crops onfarm or purchase feeds, including land availability and suitability, feed markets, preference, and other economic factors. For example, Raszap Skorbiansky (2022) indicated that midwestern organic dairy operations tended to produce their own alfalfa hay due to the hay's bulkiness and high cost of transportation.

We found differences by region in organic dairy farm adoption of technology, management practices, and production systems (table 10). Corn Belt organic dairy farms were less likely to adopt advanced reproduction technologies (e.g., artificial insemination, embryo transplants, and/or sexed semen) than Northeast and Upper Midwest farms in 2010 and 2016. In addition, Corn Belt farms were less likely to keep individual cow production records than Northeast or Upper Midwest farms in 2021 or Upper Midwest or West farms in 2010. The cost of implementing many advanced technologies, management practices, and production systems tended to decrease as operation size increased due to efficiency or scale economies, and Corn Belt organic dairy farms tended to be smaller than organic dairy farms in the other regions. Farms in the West region, which have relatively large average herd sizes, had higher uptake rates of automatic takeoffs and used milking parlors more extensively than farms in the other three dairy farm regions in 2010. Using 2005 ARMS data, McBride and Greene also found heavier milking parlor use in the West. The combination of milking parlors (which allow for more cows to be milked at a time) and automatic takeoff systems reduces labor requirements for the operation.

Table 9

Farm structure and demographics of U.S. certified organic dairy farms, 2010, 2016, and 2021

Measure	2010				2016				2021		
	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)
	Farm structure and farmer demographics										
Number of observations	218	169	117	49	149	113	91	28	62	61	70
Number of cows	64[d]	64[d]	51[d]	288[abc]	58[bcd]	76[acd]	42[abd]	414[abc]	60[c]	70[c]	44[ab]
Acres operated	415	342	199[d]	523[c]	328[c]	382[c]	177[abd]	778[c]	313[c]	282[c]	141[ab]
Acres owned	250	219	139[d]	287[c]	228[c]	240[c]	127[ab]	461	222[c]	175[c]	102[ab]
Pounds milk sold per cow	12,223[d]	13,228[cd]	11,538[bd]	16,889[abc]	13,350[b]	15,278[a]	13,192	13,989	12,391	14,778	13,192
Percent value of production from dairy	82	90	84	90	92[c]	91	83[ad]	93[c]	89	85	84
Percent farms producing:											
Corn	42[c]	79[d]	84[ad]	27[bc]	53[bcd]	79[ad]	85[ad]	26[abc]	39[b]	74[a]	64
Hay	84	86[d]	94[d]	62[bc]	81[cd]	78[cd]	94[abd]	33[abc]	66[c]	65	85[a]
Debt-to-asset ratio	15	15	12	21	17[c]	18[c]	12[abd]	24[c]	13	14	13
Average operator age	49	51	46[d]	53[c]	50[cd]	52[cd]	44[abd]	58[abc]	50[c]	51[c]	44[ab]

Note: Superscripts refer to results of statistical tests of differences between item means in each column within year category. Tests are expressed at a 90-percent level of confidence. Lettered superscripts denote that the item mean reported in a column is significantly different from that in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data, as discussed in Dubman (2000).

Source: USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service 2010, 2016, and 2021 ARMS dairy data, Dubman, R.W. (2000), and *Variance estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Surveys* (Report No. AGES 00-01), USDA, ERS.

Table 10

Adoption of technologies, management practices, and production systems in U.S. certified organic dairy farms, 2010, 2016, and 2021

Measure	2010				2016				2021		
	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)
Artificial insemination, embryo transplant, or sexed semen	69[c]	71[c]	33[ab]	D	77[c]	73[c]	48[ab]	D	76	69	64
Individual cow production records	69	71[c]	31[bd]	72[c]	72[b]	57[a]	57	72	62[c]	62[c]	31[ab]
Automatic takeoffs	15[d]	24[d]	13[d]	73[abc]	NA	NA	NA	NA	11	43	13
Nutritionist to design feed ration	50	43	42	49	NA	NA	NA	NA	39	50	30
Milking parlor	28[d]	37[d]	68[d]	100[abc]	20[bc]	42[ac]	69[ab]	D	24[c]	41	72[a]
<50 percent of forage from pasture during grazing season	42	38	37	34	55	50[d]	52	71[b]	55[c]	40	33[a]
50–74 percent of forage from pasture during grazing season	30	36	38	37	22[c]	21[c]	37[ab]	D	27[c]	19[c]	53[ab]
75–100 percent of forage from pasture during grazing season	28	26	26	28	23[c]	29[c]	11[ab]	D	18	41	14

D = Insufficient data for disclosure.

Note: Superscripts refer to results of statistical tests of differences between item means in each column within year category. Tests are expressed at a 90-percent level of confidence. Lettered superscripts denote that the item mean reported in a column is significantly statistically different from that in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data, as discussed in Dubman (2000).

Source: USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service, 2010, 2016, and 2021 ARMS dairy data, Dubman, R.W. (2000) and *Variance estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Surveys* (Report Number AGES 00-01), USDA, ERS.

Certified Organic Dairy Farm Costs and Returns by Region

In 2010, the Northeast region's organic dairy farms had a higher value of milk production and total value of production (including cattle sales and value of manure) than farms in the Upper Midwest and Corn Belt (table 10). Using 2005 ARMS data, McBride and Greene (2009) also found that the Northeast's organic dairy farms had higher total value of production per 100 pounds of milk sold than Upper Midwest farms.

A lower usage of homegrown feeds was found for organic dairy farms in the West region than farms in the other regions in 2010 and 2016. This result was consistent with McBride and Greene (2009), who used 2005 ARMS data. Northeast farms incurred higher total feed costs than Corn Belt farms in 2016 and 2021. Feed costs can differ by region, partly due to feed price differences, and Northeast grain prices generally exceeded those in the Corn Belt. Corn Belt farms depended more heavily on unpaid labor (relative to paid labor) than farms in the other regions, which can partly be explained by smaller average farm sizes in the Corn Belt. For the 2 years that we have estimates for the West region, it had the lowest capital recovery costs, which was consistent with McBride and Greene (2009) using 2005 ARMS data. Lower capital recovery costs for organic dairy farms in the West was due, in part, to the farms' ability to spread fixed costs over greater output. Likewise, total allocated overhead costs were lower in the West than in the other regions during the years for which we have western estimates, 2010 and 2016. Although we did not find differences in total costs by region for the 2021 survey data, we did find lower costs in the West for 2010 and 2016, as shown by McBride and Greene (2009), who used 2005 ARMS data. We found higher returns over both operating and total costs in the West relative to other regions. Western farms achieved higher returns due, in part, to their larger sizes and greater use of advanced technology, management practices, and production systems.

Table 11

Costs and returns of producing 100 pounds of milk of U.S. certified organic dairy farms by region, 2010, 2016, and 2021 survey years

Measure	2010				2016				2021		
	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)	West (d)	Northeast (a)	Upper Midwest (b)	Corn Belt (c)
Value of milk production	28.27^{bc}	24.69^{a}	25.15^{a}	27.49	36.52	35.33	33.80	37.83	32.06^{bc}	27.62^{a}	28.50^{a}
Value of production	30.81^{bc}	27.28^{a}	27.87^{a}	29.80	38.99	37.84	36.37	40.61	34.83^{b}	30.12^{a}	31.34
Purchased feed costs	6.58	4.00^{d}	5.37^{d}	10.39^{bc}	8.69^{bc}	5.95^{a}	6.05^{a}	10.19	7.85	6.50	7.10
Homegrown feed costs	7.26^{cd}	10.18^{d}	10.35^{ad}	3.51^{abc}	10.11^{d}	8.57^{d}	8.62^{d}	2.03^{abc}	10.11	9.09	8.20
Grazed feed costs	0.99^{cd}	0.86	0.73^{a}	0.62^{a}	0.83	0.72	0.84	1.27	0.58	0.44	0.45
Total feed costs	14.83	15.04	16.45	14.53	19.63^{bc}	15.24^{a}	15.51^{a}	13.49	18.54^{c}	16.02	15.75^{a}
Total operating costs	20.12	19.63	22.01^{d}	18.43^{c}	24.83^{bcd}	20.98^{a}	20.54^{a}	17.36^{a}	24.92^{bc}	20.28^{a}	20.32^{a}
Paid labor costs	2.18	2.12^{d}	0.77^{d}	4.07^{bc}	2.22^{cd}	2.33^{c}	0.75^{abd}	4.68^{ac}	1.80^{c}	1.45^{c}	0.43^{ab}
Unpaid labor costs	9.18^{d}	8.24^{d}	9.54^{d}	1.87^{abc}	11.60^{bd}	6.68^{acd}	12.41^{bd}	2.36^{abc}	8.72^{c}	10.96	14.65^{a}
Capital recovery costs	7.91^{d}	7.06^{d}	9.22	4.65^{ab}	4.88^{d}	4.68^{d}	4.97^{d}	3.49^{abc}	9.91^{c}	9.83^{c}	5.69^{ab}
Total allocated overhead costs	21.43^{d}	19.40^{d}	21.19^{d}	11.50^{abc}	21.07^{bd}	15.95^{ac}	20.10^{bd}	12.81^{ac}	22.81	23.87	22.26
Total costs	41.55^{d}	39.03^{cd}	43.20^{bd}	29.93^{abc}	45.90^{bcd}	36.93^{ad}	40.65^{ad}	30.17^{abc}	47.72	44.15	42.57
Returns over operating costs	10.70^{c}	7.65	5.85^{ad}	11.37^{c}	14.16^{d}	16.87^{d}	15.82^{d}	23.25^{abc}	9.91	9.84	11.03
Returns over total costs	-10.73^{d}	-11.75^{d}	-15.33^{d}	-0.13^{abc}	-6.91^{bd}	0.92^{acd}	-4.28^{bd}	10.44^{abc}	-12.90	-14.03	-11.23

Note: Superscripts refer to results of statistical tests of differences between item means in each column within year category. Tests are expressed at a 90-percent level of confidence. Lettered superscripts denote that the item mean reported in a column is significantly statistically different from that in the superscript column. Tests were conducted using a delete-a-group jackknife variance estimator, with 30 replicates provided with the Agricultural Resource Management Survey (ARMS) data, as discussed in Dubman (2000).

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Conclusion

Increased consumer demand for certified organic foods and the establishment of the USDA's National Organic Program (NOP) in 1990 offered U.S. dairy farmers a new market for milk, provided the farmers were willing to incur the costs associated with organic transition and adhere to NOP's organic production standards. Certified organic milk production has grown over the last several decades, increasing its share of the total U.S. milk market. With this growth, production locations have shifted, with Texas recently emerging as the top U.S. producer of certified organic milk, whereas Idaho and New Mexico have also increased their shares of production. Texas, Idaho, and New Mexico all have larger-than-average sized organic dairy farms. Although USDA's Agricultural Resource Management Survey (ARMS) data do not indicate major changes in organic dairy farm structure (as measured by farm size, diversification, and adoption of technologies, management practices, and production systems over the past two decades), the largest U.S. certified organic dairy farms may be underrepresented in recent ARMS dairy samples.

Cost and return estimates based on the 4 ARMS survey years (2005, 2010, 2016, and 2021) suggest that the average U.S. certified organic dairy farm covered feed and operating costs for all 4 years surveyed, but organic dairy farms covered total economic costs only in 2016. Nonetheless, returns over operating costs and total economic costs were generally higher for organic dairy farms than for similarly sized conventional dairy farms, and returns over total costs for organic dairy farms increased with farm size. Larger farms and farms in the western United States tended to be the greater adopters of advanced technologies, management practices, and production systems. Further research on the economics of certified organic dairy production could focus more heavily on the largest sized organic dairy farms to examine the farms' competitiveness with smaller sized organic dairies and similarly sized conventional dairy farms.

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Appendix: Changes in Organic Dairy Production Requirements

Table A.1
Changes in organic dairy production requirements, 1990 to 2023

Year	Name of legislation or rule	Details for dairy cows or milk products
1990	Organic Foods Production Act of 1990 (7 U.S.C. 6518)	Milk and milk products sold or labeled as organic must originate from dairy animals raised organically for 12 months prior to the sale of the product.
2000	National Organic Program Final Rule (65 FR 80547)	Milk or milk products must be from animals under continuous organic management at least 1 year prior to production of products to be sold, labeled, or represented as organic. Exceptions on transition provisions include when an "entire, distinct herd" is converted to organic production, and for the first 9 months, feed must be at a minimum 80 percent organic. Twenty percent may be nonorganic, excluding prohibited substances. For the final 3 months prior to milk production, 100 percent of feed must be organic (i.e., 80/20 rule). After the entire, distinct herd has been converted to organic production, all dairy animals must be under organic management from the last third of gestation.
2005	2005 Amendment to the Organic Foods Production Act of 1990 (7 U.S.C. 6509(e)(2)(B))	A court found the 80/20 dairy rule contrary to Organic Food Production Act (OFPA) after ruling on a case (Harvey versus Johanns). Congress amended OFPA with a transition guideline: Farms also transitioning crops and forage land to organic can feed dairy animals from land in its third year of transition during the 12-month period immediately prior to the sale of organic milk and milk products.
2006	Revisions to Livestock Standards, based on court order (71 FR 32803)	Set a termination of the 80/20 feed conversion rule and added the new OFPA allowance permitting transitioning dairy animals to be fed feed from land in its last year of the 3-year transition period.
2006	NOP 5003 Dairy Animal Acquisition under the NOP regulation	Guidelines allowed organic milk operations certified before October 21, 2002, or those that transitioned by feeding cattle 100 percent organic feed to acquire additional nonorganic cattle for transition. The guidelines prohibited organic milk operations that transitioned their cattle using the 80/20 exemption from transitioning additional cattle.
2010	Access to Pasture Rule for Organic Livestock (75 FR 7153)	Established enforceable pasture standards (including year-round access to the outdoors), providing ruminants with pasture throughout the grazing season for their geographical location and ensuring ruminants derive not less than an average of 30 percent of their dry matter intake requirement from pasture grazed over the course of the grazing season (for a minimum of 120 days).
2011–21	Origins of Livestock Proposed Rule	The 2010 rule did not address origin of livestock or transition requirements. However, after the 2006 revisions and guidelines, USDA, Agricultural Marketing Service (AMS) received requests on clarity on transitioning requirements. In 2013, a USDA Office of Inspector General audit of organic milk operations found that interpretation on transition of "entire, unique herds" differed across producers and certifying agents. Some certifier agents used the exemption to allow dairy to continually transition nonorganic dairy animals into organic production by classifying the group of dairy animals as a "distinct" herd. USDA, AMS proposed a rule in 2015 and reopened the rule again for comments in 2019 and 2021.

Year	Name of legislation or rule	Details for dairy cows or milk products
2022	Origins of Livestock Final Rule	Exceptions for transitioning herds now state that once an entire, distinct herd has been transitioned to organic production, all dairy animals must be managed organically. Under the new rule, a nonorganic dairy operation may transition to organic production on a one-time basis, with all animals ending their transition at the same time after a 12-month period of organic management. Once the operation has transitioned the dairy animals, that operation cannot transition additional animals or source transitioned animals. Any dairy animal added thereafter must have been organically managed from the last third of gestation (i.e., about 3 months before birth). The rule took effect on June 6, 2022, and all operations were required to comply with its provisions by April 5, 2023.
2023	Organic Livestock and Poultry Standards	This rule updates organic regulations to promote animal welfare and encourage consistent livestock production practices. As the rule applies to dairy cows, the rule requires that operations provide shelter that allows dairy cows to move, stretch, and express natural behaviors over a 24-hour period and have unrestricted outdoor access year-round. Dairy young stock can be housed in individual housing until the weaning process is complete, as long as they are designed so that they can see, smell, and hear other animals—and such that they have sufficient room to turn around, lie down, stretch out while lying down, get up, rest, and groom themselves. Once weaning is complete, a dairy operation can no longer confine dairy young stock unless for a permitted reason. The rule also revised production practices and care standards, including documenting treatment of sick or injured animals (e.g., monitoring for lameness) and restricting physical alterations to be made only for safety or identification.

Source: USDA, Economic Research Service using the names of the regulations or rules that are listed in the second column of this table.