



# Milk Production Methodology and Quality Measures

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## Milk Production Survey Methodology

**Scope and Purpose:** The Milk Production Survey, conducted in all states in January, April, July, and October, collects information on the number of all milk cows in the herd, number of cows milked on the first day of the survey month, and total milk produced on the first day of the survey month. Information on milk cow replacement prices are collected each quarter and information on heifer replacement prices are collected in January. In April and October, producers provide information on the amount of milk used on the farm for food or drink and the amount fed to calves.

All questions concerning milk cow inventory, milk production, milk used on the operation, and average price per head for milk cows and heifers for dairy herd replacement are asked in all fifty states.

**Survey Timeline:** The reference date for the Milk Production Survey is the 1st of each Quarter (January, April, July, and October), with a data collection period of approximately 15 calendar days. Field Offices may begin data collection one day prior to the reference date. Data collection continues until a scheduled ending date and Field Offices have about 4 or 5 business days to complete editing and analysis, execute the summary, and interpret the survey results. The national milk production statistician must review the state estimates and prepare the official estimates for release in about 4 business days. "Milk Production", usually released around the 18th or 19th of each month, includes monthly estimates of milk production, milk per cow, and number of milk cows for the 23 major States. Quarterly estimates of milk production and number of milk cows are published for all 50 States in the January, April, July, and October "Milk Production" publications. Annual milk production revisions are published for all 50 States in February.

**Sampling:** The target population for the Milk Production Survey is all agricultural establishments with one or more head of milk cows on the land operated. The Milk Production Survey is conducted in every state.

NASS uses the list frame for the Milk Production Survey. The list frame includes all known agricultural establishments. A profile, known as control data, of each establishment is maintained on the list frame to allow NASS to define list frame sampling populations for specific surveys and to employ efficient sampling designs. Only list frame records with positive milk cow control data are included in the Milk Production list frame population.

The criterion for being in the survey is that the operation has at least one milk cow. The sample size for the Milk Production Survey is approximately 12,000. The sample is selected using a stratified sampling design with strata defined by the total number of milk cows. The sample is first used in the January survey quarter or the "base" survey quarter, which is the initial quarter of the survey year. The "follow-on" quarters in the survey year use the same "base" sample. New milk operations found during the survey year can be added to the sample.

**Data Collection and Editing:** For consistency across modes, the paper version is considered the master questionnaire and the web and Computer Assisted Telephone Interview (CATI) instruments are built to model the paper instrument. Questionnaire content and format are evaluated annually through a specifications process where requests for changes are evaluated and approved or disapproved. Input may vary from question wording or formatting to a program change involving the deletion or modification of current questions or addition of new ones. If there are significant changes to either the content or format proposed, a NASS survey methodologist will pre-test the changes for usability. Prior to the start of data collection, all modes of instruments are reviewed and web and CATI instruments are thoroughly tested. All federal data collections require approval by the Office of Management and Budget (OMB). NASS must document the public need for the data, show the design applies sound statistical practice, ensure the data do not already exist elsewhere,

and that the public is not excessively burdened. The milk questionnaire must display an active OMB number that gives NASS the authority to conduct the survey, a statement of the purpose of the survey and the use of the data being collected, a response burden statement that gives an estimate of the time required to complete the form, a confidentiality statement that the respondent's information will only be used for statistical purposes in combination with other producers, and a statement saying that response to the survey is voluntary and not required by law.

Sampled farms and ranches receive a presurvey letter explaining the survey and that they will be contacted for survey purposes only. The letter provides the questions to be asked to allow respondents to prepare in advance and also provides a pass code they can use to complete the survey on the internet. All modes of data collection are utilized for the Milk Production Surveys. Field Offices are given the option of conducting a mail out/mail back phase. While mail is the least costly mode of collection, the short data collection period and the uncertainty of postal delivery times limit its effectiveness. Most of the data are collected by computer-assisted telephone interviews (CATI) by individual Field Offices and Data Collection Centers. Limited personal interviewing is done, generally for large operations or those with special handling arrangements. A program is run to determine if any sampled farms are in multiple on-going surveys, so data collection can be coordinated.

**Survey Edit:** As survey data are collected and captured, they are edited for consistency and reasonableness using automated systems. Reported data are typically first edited as a "batch" of data when first captured. Relationships between data items on the current survey are verified and in certain situations those items may be compared to data from earlier surveys to make sure certain relationships are logical. The edit will determine the status of each record to be either "dirty" or "clean". Dirty records must be updated and reedited or certified by an analyst to be clean. If updates are needed, they are reedited interactively. Only clean records are eligible for analysis and summary.

**Data Analysis Tool:** Milk Production utilizes an Interactive Data Analysis System (IDAS) tool to assist in reviewing and analyzing the data. The IDAS provides various graphical scatter plots, tables, and special tabulations that allow the analyst to compare an individual record to other similar records within their state. The tool is very beneficial in identifying outliers and other unusual data relationships. IDAS is a tool that permits commodity analysts to interact with survey data on screen at several levels. Preliminary or final data can be viewed relative to other reports at a stratum level throughout the survey process as soon as records have cleared the internal edit consistency checks. This affords more time for the analysts to recognize and react to problematic data.

The IDAS instrument identifies key characteristics of the sample data that should be reviewed closely. Interactive potential outliers and graphical displays of the data are available to identify potential outliers in the sample. Detailed information is available at the state, stratum and record level. The record-level information includes current and historic data for the sampling unit. Strata-level and state-level statistics and survey indications are provided (direct expansions, matched record ratios and averages).

**Estimators:** Each milk cow farm and ranch in the sample has an initial sampling weight. This weight is the inverse of the sampling fraction. For example, if a milk cow stratum has 1,000 farms in the population and 200 are sampled for this survey, each sampled farm has a weight of 5. In other words, each sampled farm represents 5 farms.

Response to the Milk Production Survey is voluntary. Some producers refuse to participate in the survey. Others cannot be contacted during the data collection period, and some submit incomplete reports. These non-respondents must be accounted for if accurate estimates of milk are to be made. For the Milk Survey, non-respondents are accounted for by adjusting the weights of the respondents. The adjustment occurs by stratum as the bounded strata represent homogeneous groupings of similar sized milk cow farms. The largest stratum is unbounded and is made up of operations with a large number of milk cows. Non-respondents in the unbounded stratum must be manually estimated by Field Office statisticians, and their stratum sampling weights are not adjusted. The adjustment is performed by individual item on the questionnaire (total milk cows, cows milked, milk production) so adjustments for item non-response (partial reports) and unit non-response (refusal and inaccessible reports) are done in a single calculation. Using the previous example, if 160 of the original 200 respond, the weights of the 160 will be adjusted to 1,000 divided by 160, or 6.25.

Two estimators are used to compute direct measures of the milk items. The "reweighted" estimator and the "adjusted" estimator are computationally identical except in how the non-response adjustments are made. The reweighted estimator

uses a global weight adjustment across all complete and estimated complete (usable) reports. The non-response weight adjustment for the adjusted estimator uses an additional piece of information, based on the presence/absence of milk cows. When a sampled farm refuses to cooperate, interviewers can probe to determine the presence of milk cows even though the number of milk cows is not known. Also, automated edit logic that is based on historic and administrative data ensures the coding of the presence indicator value. This presence/absence indicator is used in the weight adjustment.

Point estimates, called direct expansions, for both estimators are calculated by multiplying the reported value by the non-response weight and summing to a stratum total. A variance estimate is also computed at the stratum level. Totals and variances are additive across strata to form a state estimate and states are additive to a national estimate.

Ratio estimates are also computed for many items. For example, milk yield is estimated as a ratio of milk production to total milk cows. Ratio estimates use the reweighted estimator described above for the numerator and denominator, except a report is not usable unless both items are reported.

**Estimation:** Indicators from the quarterly Milk Production Surveys, along with external information (administrative data) from various sources, provide data for estimating number of milk cows and milk production on a monthly and quarterly basis. In order to be considered, these administrative data must be deemed to be reliable and come from unbiased sources. The most common administrative data are Federal Milk Marketing Order statistics.

When all Milk Production Survey samples are accounted for, all responses fully edited, and the analysis material is reviewed, each Field Office executes a summary for their state. When all Field Offices have run summaries, Headquarters executes the national summary. Since all states conduct identical surveys, the samples can be pooled and national survey results computed. The summary results provide point estimates and precision measures for each item being estimated. It also provides information used to assess the performance of the current survey and evaluate the quality of the survey estimates, such as strata level expansions, response rates, and percent of the expansion from usable reports.

Field Offices are responsible for performing a detailed review of their survey results. Any irregularities revealed by the summary must be investigated and, if necessary, resolved. Using the historical relationship of the survey estimates to the official estimate, Field Offices must interpret the survey results and submit recommended estimates to Headquarters for all milk cows, milk production, and milk per cow. The data are viewed in tabular and graphical form. Field Offices see their survey results only and do not have access to other states' results.

The national estimates are determined using the "bottom-up" approach. After the Field Offices submit the recommended estimates for each state, the national milk production statistician reviews the individual state estimates for reasonableness. When analyzing the state estimates, the national statistician has an advantage in being able to examine results across states and compare the state recommendations. When the review of the individual state estimates is complete, the national estimates are determined by summing the estimates for each state. The Agricultural Statistics Board reviews the national estimates for reasonableness.

Milk production, milk per cow, and number of milk cows are subject to revision the following month after initial publication for monthly States or the following quarter for the quarterly States. Normally, administrative data from Federal Market Orders, State Departments of Agriculture, or other sources are the main basis for revisions. However, administrative data for all States may not be available in time for these revisions. Estimates are again subject to revision in February each year based on additional administrative data. In the event that additional changes are necessary, a third revision is possible in February the following year.

Every five years, NASS conducts the Census of Agriculture, which is an exhaustive data collection effort for all known farm operations across the United States. Estimates are thoroughly reviewed for possible revision after data from the five-year Census of Agriculture are available. The information gathered from the Census of Agriculture is used to establish "bench mark" levels by which the survey estimators can be compared and bias determined. Survey based estimators can also be impacted by "outliers" – individual reports that have "excessive influence" on the results due to either improper classification or extremely unusual data for a given operation (i.e. operation is not representative of other operations). NASS thoroughly reviews the survey data to identify these situations and consider their impact on the survey results when establishing the official estimates.

## Quality Metrics for Milk Production

**Purpose and Definitions:** Under the guidance of the Statistical Policy Office of the Office of Management and Budget (OMB), the United States Department of Agriculture's National Agricultural Statistics Service (NASS) provides data users with quality metrics for its published data series. The metrics tables below describe the performance data for all surveys contributing to the publication. The accuracy of data products may be evaluated through sampling and non-sampling error. The measurement of error due to sampling in the current period is irrelevant for a fully enumerated data series. Non-sampling error is evaluated by response rates and the percent of the estimate from reported data.

**Sample size** is the number of observations selected from the population to represent a characteristic of the population.

**Response rates** is the proportion of the sample that responded to the survey.

**Percent of expansion from usable reports** is a ratio of survey data expanded by the original sampling weight compared to survey data expanded by the nonresponse adjusted weight.

**Coefficient of variation** provides a measure of the size for the standard error relative to the point estimate and is used to measure the precision of the results of a survey estimator.

**Milk Production Survey Sample Size and Response Rates:** To assist in evaluating the performance of the estimates in the quarterly milk production report, the sample size and response rates are displayed. Response rates overall for 2013 and 2014 are displayed.

### Milk Production Survey Sample Size and Response Rates - United States: January 1, 2013-2014

	Sample size		Response rates	
	2013	2014	2013	2014
	(number)	(number)	(percent)	(percent)
United States .....	12,080	11,693	72.9	70.5

### Quality Metrics for Milk Production Survey - United States: January 1, 2013-2014

Class	Percent of expansion from usable reports		Coefficient of variation	
	2013	2014	2013	2014
	(percent)	(percent)	(percent)	(percent)
Milk production .....	75.5	75.2	0.61	0.73
Milk cows .....	74.8	74.5	0.62	0.77

**Milk Production Survey Sample Size and Response Rates – States and United States:  
January 1, 2013-2014**

State	Sample size		Response rates	
	2013 (number)	2014 (number)	2013 (percent)	2014 (percent)
Alabama .....	60	54	93.3	72.2
Alaska .....	23	25	82.6	72.0
Arizona .....	78	73	76.9	84.9
Arkansas .....	108	93	90.7	79.6
California .....	565	538	61.9	67.3
Colorado .....	121	118	90.1	87.3
Connecticut .....	114	111	82.5	67.6
Delaware .....	31	29	80.6	82.8
Florida .....	115	114	81.7	81.6
Georgia .....	172	172	80.2	79.7
Hawaii .....	8	7	75.0	100.0
Idaho .....	262	256	74.0	74.6
Illinois .....	386	379	78.2	75.7
Indiana .....	435	442	57.9	65.6
Iowa .....	483	479	49.7	61.4
Kansas .....	198	194	71.7	72.2
Kentucky .....	394	384	79.2	84.6
Louisiana .....	101	96	84.2	82.3
Maine .....	154	150	83.8	72.0
Maryland .....	288	292	73.6	77.1
Massachusetts .....	111	107	76.6	61.7
Michigan .....	562	518	69.4	65.1
Minnesota .....	791	700	64.0	55.3
Mississippi .....	84	82	85.7	85.4
Missouri .....	416	407	68.3	69.5
Montana .....	96	97	87.5	90.7
Nebraska .....	159	159	71.7	71.1
Nevada .....	33	29	63.6	82.8
New Hampshire .....	126	123	84.9	73.2
New Jersey .....	71	73	91.5	71.2
New Mexico .....	128	123	69.5	74.0
New York .....	927	902	73.8	67.8
North Carolina .....	144	147	91.0	90.5
North Dakota .....	106	103	69.8	55.3
Ohio .....	603	585	69.8	59.8
Oklahoma .....	154	155	77.9	80.6
Oregon .....	146	156	74.7	78.2
Pennsylvania .....	603	565	71.3	65.8
Rhode Island .....	20	20	85.0	75.0
South Carolina .....	67	68	79.1	88.2
South Dakota .....	172	170	69.8	75.9
Tennessee .....	197	191	80.2	70.2
Texas .....	363	341	71.9	80.4
Utah .....	169	167	85.8	77.2
Vermont .....	339	334	87.0	75.1
Virginia .....	295	284	75.9	72.9
Washington .....	267	265	77.5	73.2
West Virginia .....	98	96	80.6	78.1
Wisconsin .....	715	700	73.7	65.1
Wyoming .....	22	20	95.5	90.0
United States .....	12,080	11,693	72.9	70.5

## Quality Metrics for Milk Production Survey - States and United States: January 1, 2013-2014

State	Milk production				Milk cows			
	Percent of expansion from usable reports		Coefficient of variation		Percent of expansion from usable reports		Coefficient of variation	
	2013	2014	2013	2014	2013	2014	2013	2014
	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)
Alabama .....	88.8	78.7	3.68	3.59	89.2	77.7	3.95	3.33
Alaska .....	91.2	94.8	11.04	3.73	88.3	93.0	14.34	3.23
Arizona .....	88.3	88.4	3.08	1.73	88.1	88.1	2.71	1.69
Arkansas .....	93.4	80.5	1.92	3.54	93.0	80.0	1.76	3.61
California .....	61.1	67.6	2.14	2.99	60.8	67.7	2.11	3.33
Colorado .....	96.1	95.8	0.53	0.68	95.9	95.8	0.44	0.58
Connecticut .....	92.3	84.2	2.01	1.90	90.9	81.3	2.04	2.33
Delaware .....	88.0	84.8	4.09	2.68	86.0	84.2	5.50	3.06
Florida .....	88.2	89.7	2.19	1.40	88.2	88.8	1.90	1.33
Georgia .....	90.6	91.9	1.47	1.21	90.0	90.9	1.35	1.19
Hawaii .....	99.8	100.0	0.14	0.00	99.5	100.0	0.36	0.00
Idaho .....	89.0	86.5	0.85	1.33	88.4	86.0	0.77	1.28
Illinois .....	81.9	78.5	2.27	2.40	81.0	77.4	2.02	2.23
Indiana .....	74.5	77.8	1.87	2.14	72.0	75.3	1.89	2.13
Iowa .....	60.3	71.2	2.31	2.47	57.3	69.4	2.52	2.68
Kansas .....	94.1	93.2	1.23	1.33	93.4	92.5	1.02	1.22
Kentucky .....	77.9	86.5	2.88	2.54	77.0	85.5	2.68	2.68
Louisiana .....	85.7	84.0	3.02	3.72	84.8	83.3	2.74	3.80
Maine .....	89.2	83.1	2.44	2.74	87.5	79.9	2.31	3.00
Maryland .....	79.7	82.3	2.00	1.99	78.6	81.5	2.06	1.82
Massachusetts ...	80.7	71.6	2.89	3.71	80.4	70.3	3.01	3.20
Michigan .....	72.7	71.9	1.60	1.71	72.5	70.8	1.34	1.51
Minnesota .....	65.2	59.8	2.20	2.64	65.1	59.3	2.13	2.44
Mississippi .....	89.6	91.5	2.71	4.04	89.0	90.8	2.81	3.32
Missouri .....	70.2	69.8	2.96	5.58	71.1	71.3	2.76	5.32
Montana .....	91.8	94.2	1.29	1.75	91.1	93.8	1.26	2.55
Nebraska .....	88.1	87.5	1.17	1.66	86.0	85.9	1.21	1.80
Nevada .....	89.9	98.2	2.72	0.82	86.8	97.7	2.41	0.96
New Hampshire .	92.5	87.2	1.38	2.47	91.1	84.3	1.30	2.70
New Jersey .....	94.8	74.7	2.23	4.50	93.9	73.9	1.98	3.90
New Mexico .....	73.6	79.9	2.87	2.10	73.3	80.2	2.99	1.81
New York .....	81.2	74.7	1.40	1.52	79.2	73.3	1.42	1.56
North Carolina ...	93.9	93.7	1.86	1.98	93.2	93.2	1.71	1.87
North Dakota .....	81.1	74.7	3.87	4.42	76.8	70.8	3.06	3.98
Ohio .....	75.8	63.8	2.14	2.33	74.5	63.0	2.13	2.34
Oklahoma .....	90.5	93.0	1.38	1.32	88.1	91.0	1.44	1.56
Oregon .....	80.4	87.0	2.87	2.26	81.2	86.9	2.40	1.98
Pennsylvania .....	70.2	65.1	3.17	3.96	68.4	63.6	3.01	3.58
Rhode Island .....	94.2	91.9	3.25	4.41	93.0	91.2	3.79	4.78
South Carolina ...	82.0	92.4	7.28	7.15	81.6	92.2	7.03	7.32
South Dakota .....	86.3	88.7	1.78	1.77	85.2	88.0	1.76	1.75
Tennessee .....	81.9	74.9	3.40	3.65	81.1	73.7	2.71	2.93
Texas .....	75.9	89.8	2.01	1.11	75.4	89.1	2.30	0.98
Utah .....	93.5	88.0	0.75	3.31	92.6	86.7	0.75	3.09
Vermont .....	90.7	82.5	1.85	1.93	90.0	80.7	1.88	1.86
Virginia .....	76.6	73.4	2.44	2.86	76.2	73.2	2.23	2.75
Washington .....	84.8	82.0	0.87	1.28	84.7	81.5	0.76	1.25
West Virginia .....	82.3	78.6	11.49	5.11	81.9	77.1	10.53	6.26
Wisconsin .....	75.5	69.1	2.36	2.28	74.7	68.2	2.70	2.44
Wyoming .....	99.8	98.5	2.90	3.78	99.0	97.7	9.41	4.80
United States .....	75.5	75.2	0.61	0.73	74.8	74.5	0.62	0.77

## Information Contacts

Process	Unit	Telephone	Email
Estimation .....	Livestock Branch	(202) 720-3570	HQ_SD_LB@nass.usda.gov
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Questionnaires .....	Data Collection Branch	(202) 720-6201	HQ_CSD_DCB@nass.usda.gov
Sampling and Editing.....	Sampling, Editing, and Imputation Methodology Branch	(202) 720-8671	HQ_CSD_SB@nass.usda.gov
Summary and Estimators .....	Summary, Estimation, and Disclosure Methodology Branch	(202) 720-4008	HQ_SD_SMB@nass.usda.gov
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