



# Cash Rents Methodology and Quality Measures

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## Cash Rents Survey Methodology

**Scope and Purpose:** The Cash Rents Survey is conducted on annual basis. The survey obtains acres rented and cash rental rates from a statistically representative sample of farmers and ranchers in the United States, excluding Alaska. This survey provides the basis for estimates of the current year’s cash rents paid for irrigated cropland, non-irrigated cropland, and permanent pastureland. Due to the scarcity of irrigated pastureland, estimates are not established for irrigated and non-irrigated pastureland. State and county level cash rent estimates are published, in so far as they meet disclosure rules and publication standards.

The cash rents estimates provide basic information needed by farmers to make decisions for both short-term and long-term agricultural production planning. These estimates may be used by individual producers in planning for their agricultural operation or by Agricultural Extension Services or university staff in developing operating budgets for agricultural operations in their locale.

The United States Department of Agriculture’s National Agricultural Statistics Service (NASS) was directed through the 2008 Farm Bill as amended by the Agricultural Act of 2018 to collect cash rents data for use by the Farm Service Agency (FSA) in program administration. The amended Food, Conservation, and Energy Act of 2008, Section 2110, states, “The Secretary (acting through the National Agricultural Statistics Service) shall, not less frequently than once every other year, (amended in 2018 to annual) conduct a survey of per acre estimates of county average market dry land and irrigated cash rental rates for cropland and pastureland in all counties or equivalent subdivisions within each state that have 20,000 acres or more of cropland and pasture.”

**Survey Timeline:** The Cash Rents Survey data collection period begins in mid-February and ends in June. Data collection is coordinated with other surveys being conducted during this period. National and state level cash rents estimates are published in August for all states, excluding Alaska. County level cash rents estimates are also published in August.

**Sampling:** The target population for the cash rents estimate program is all farms and ranches with \$1,000 or more in agricultural sales (or potential sales) who rent land from others on a cash rent basis. The Cash Rent Survey sample is selected from a list frame of farm and ranch operators maintained by NASS. NASS is constantly seeking qualifying farming operations from outside sources to be added to the list. A profile, known as control data, of each operation is maintained which indicates what the farm has historically produced and a general indication of size. This information allows NASS to define sampling populations that are specific to each survey and employ advanced and more efficient sample designs.

Samples for the Cash Rents Survey are drawn with a county level stratified design to produce state and county level estimates. Large operations in each county are stratified into the census strata, where all are included in the sample. The national sample size for the Cash Rents Survey is approximately 245,000.

**Data Collection:** 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 does not already exist elsewhere, and show that the public is not excessively burdened. The Cash Rents questionnaires 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 be protected from disclosure, and a statement that response to the survey is voluntary and not required by law.

Data collection for the Cash Rents Survey is mainly conducted by mail and telephone. The initial mail-out occurs in mid-February followed by a second mailing in early April. A third mailing targeting low response counties was completed May 20. A letter is enclosed with the questionnaire for the respondent to complete and return by mail. The questionnaire can also be completed securely online. Non-response phone follow-up is conducted using Computer Assisted Telephone Interviews at Data Collection Centers from April to July.

**Survey Edit:** As survey data are collected and captured, they are edited for consistency and reasonableness using automated systems. The edit logic ensures administrative coding follows the methodological rules associated with the survey design. Relationships between data items on the current survey are verified and, in certain situations, items are compared to data from earlier surveys to make sure certain relationships are logical. The edit determines the status of each record to be either "dirty" or "clean" (i.e., failing or passing the edit requirements for consistency and reasonableness). Dirty records must be updated and re-edited or certified by an analyst to be accurate. Corrected data are re-edited interactively. Only clean records are eligible for analysis tools and summary.

**Analysis Tools:** Edited survey records are processed and analyzed with interactive data analysis tools which display data for all reports by item. The tools provide scatter plots, tables, charts, and special tabulations that allow the analyst to compare record level data with previously reported data for the same record and reported data from similar records. Atypical responses and unusual data relationships are revealed by the analysis tool. RFO and Headquarters (HQ) staff review such relationships to determine if they are correct. Data found to be in error are corrected, while accepted data are retained.

**Nonsampling Errors:** Nonsampling errors are present in any survey process. These errors include reporting, recording, editing, and imputation errors. Steps are taken to minimize the impact of these errors, such as questionnaire testing, comprehensive interviewer training, validation and verification of processing systems, application of detailed computer edits, and evaluation of the data via the analysis tool.

**Nonresponse Adjustment:** Response to the Cash Rents Survey is voluntary. Some producers refuse to participate in the survey, others cannot be located during the data collection period, and some submit incomplete reports. These nonrespondents must be accounted for if accurate estimates of cash rental rates are to be made. Nonresponse adjustments are made through reweighting techniques applied to the data from reporting farms and ranches.

**Estimators:** The Cash Rents Survey uses a "reweighted" estimator to compute direct measures of acres rented for cash. Each farm and ranch in the sample has an initial sampling weight. This is the inverse of the sampling fraction. For example, if a stratum has 1,000 farms in the population and 200 are sampled for this survey, each sampled farm has a weight of five. In other words, each sampled farm represents five farms. The reweighted estimator uses a global weight adjustment across all usable reports. Using the previous example, if 180 of the original 200 respond, the weights of the 180 will be adjusted to 1,000 divided by 180, or 5.56.

Point estimates, called direct expansions, are calculated by multiplying the reported value by the nonresponse-adjusted 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 national estimates.

Ratio estimates are also computed for many items. For example, cash rent per acre values are calculated as the ratio of total rent paid to total acres rented. Ratio indications use the reweighted estimator described above for the numerator and denominator direct expansions. Both the numerator and denominator must be usable in order for that record to be used in the ratio estimator.

**Outliers:** NASS conducts a review of outliers found in cash rents data by reviewing rental rates for all records by practice (irrigated cropland, non-irrigated cropland, or permanent pastureland). RFO and HQ staff work together to review outliers and to ensure the most accurate data possible. A determination is made as to whether an adjustment to the cash rental rate

estimate is required. Most outliers trace back to unique situations that do not exist in the target population as much as the survey weight would indicate.

**Estimation:** When all samples are accounted for, all responses fully edited, and the analysis material reviewed, each RFO executes summaries that generate state and county level totals and ratios. The summary results provide multiple point and ratio estimates and information used to assess the performance of the survey and evaluate the quality of the survey estimates. RFOs are responsible for performing a detailed review of their survey data, interpreting the Cash Rent Survey indications, and submitting state level estimate recommendations to HQ. Staff must provide justification to the Agricultural Statistics Board (ASB) in cases where recommendations deviate from survey results. The ASB reviews all state and county level recommendations and establishes official estimates.

Beginning with the 2022 estimate year, model-based state-level estimates were incorporated into the NASS cash rental rates process. Bayesian small area models for state-level rented acre totals and rental rates were fit separately for irrigated cropland, non-irrigated cropland, and permanent pastureland. The rented acreage model uses current year survey expansions and standard errors, and previous official statistics as input. Rental rate model incorporates current and previous year survey ratios, the corresponding sampling variances, previous official statistics, percentage of farmland by land types based on Census of Agriculture, population density, and the number of reports obtained at state level. Model based and corresponding standard deviations were calculated as posterior means and posterior standard deviations, respectively. The coefficients of variation were calculated as the variation were calculated as the ratios of standard deviations and corresponding estimates multiplied by 100.

Beginning with the 2021 estimate year, model-based county-level estimates were incorporated into the NASS estimation process for county-level rates. Bayesian small area models for county-level rented acre totals and rental rates were fit separately for each practice and processed in batches; common methodologies were applied nationwide. The rented acreage models input current year survey expansions and standard errors and previous year official statistics. Rental rate models input current and previous year survey ratios and standard errors, previous official statistics, a National Commodity Crop Productivity Index variable, and the number of reports obtained. Model based estimates and corresponding standard deviations were calculated as posterior means and posterior standard deviations, respectively. These county-level estimates were benchmarked against state-level official estimates established by the ASB. For county-level ratios, coefficients of variation were calculated as ratios of standard deviations and corresponding estimates multiplied by 100.

### **Model-Based Coefficients of Variation (CVs):**

For county-level ratios, coefficients of variation were calculated as ratios of model-based standard deviations and corresponding point estimates multiplied by 100. Nationwide, NASS published 2,418 county-level non-irrigated cash rental rates estimates including other counties. The 25<sup>th</sup>, 50<sup>th</sup>, and 75<sup>th</sup> percentiles for reported coefficients of variation were 3.2%, 4.7%, and 7.1%, respectively. For irrigated cropland, 697 county-level cash rental rate estimates including other counties were published. The 25<sup>th</sup>, 50<sup>th</sup>, and 75<sup>th</sup> percentiles for reported coefficients of variation were 3.2%, 6.1%, and 8.9%, respectively. For pasture cropland, 1,936 county-level cash rental rate estimates including other counties were published. The 25<sup>th</sup>, 50<sup>th</sup>, and 75<sup>th</sup> percentiles for reported coefficients of variation were 4.7%, 6.5%, and 9.7%, respectively.

### **Quality Metrics for the Cash Rents Survey**

**Purpose and Definitions:** Under the guidance of the Statistical Policy Office of the OMB, NASS provides data users with quality metrics for its published data series. The metrics tables in this document describe the performance data for the survey contributing to the publication. The accuracy of data products may be evaluated through sampling and nonsampling error. The measurement of error due to sampling in the current period is evaluated by the coefficient of variation for each estimated item. Nonsampling error is evaluated by response rates.

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

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

**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.

## Cash Rents Quality Measures – States and United States: 2022

Region and State	Sample size (number)	Response rate (percent)	Coefficient of variation		
			Irrigated cropland (percent)	Non-irrigated cropland (percent)	Pastureland (percent)
<b>Northeast</b>					
Connecticut .....	468	52.8	(NA)	5.8	(NA)
Delaware .....	295	41.0	6.0	3.4	(NA)
Maine .....	736	53.4	(NA)	10.0	(NA)
Maryland .....	1,687	44.5	5.0	3.0	3.9
Massachusetts ...	768	53.4	4.6	5.7	(NA)
New Hampshire ..	325	59.0	(NA)	8.5	(NA)
New Jersey .....	969	54.2	5.2	6.6	(NA)
New York .....	3,978	47.3	7.6	5.1	6.4
Pennsylvania .....	4,967	44.9	5.8	3.0	4.2
Rhode Island .....	132	46.6	(NA)	(NA)	(NA)
Vermont .....	862	61.7	(NA)	6.9	(NA)
<b>Lake</b>					
Michigan .....	5,112	53.9	4.4	2.0	5.3
Minnesota .....	8,288	42.9	4.2	1.4	3.3
Wisconsin .....	6,374	49.3	4.0	2.1	4.7
<b>Corn Belt</b>					
Illinois .....	8,721	49.0	2.8	1.0	1.8
Indiana .....	6,995	45.7	2.1	1.0	3.5
Iowa .....	11,265	45.6	2.6	0.6	1.3
Missouri .....	11,553	47.7	2.7	1.7	1.7
Ohio .....	6,743	46.7	5.1	1.5	4.3
<b>Northern Plains</b>					
Kansas .....	11,323	45.6	3.9	1.8	1.4
Nebraska .....	11,186	48.7	1.4	1.4	2.7
North Dakota .....	5,845	42.3	3.9	2.1	2.1
South Dakota .....	7,303	49.0	2.4	1.1	3.7
<b>Appalachian</b>					
Kentucky .....	7,749	60.2	4.0	1.4	2.1
North Carolina ....	7,255	49.5	2.9	1.8	3.0
Tennessee .....	7,609	55.5	2.6	2.3	1.8
Virginia .....	6,076	54.5	5.9	2.2	2.6
West Virginia .....	2,020	55.0	(NA)	7.0	4.2

See footnote(s) at end of table.

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**Cash Rents Quality Measures – States and United States: 2022 (continued)**

Region and State	Sample size	Response rate	Coefficient of variation		
			Irrigated cropland	Non-irrigated cropland	Pastureland
	(number)	(percent)	(percent)	(percent)	(percent)
<b>Southeast</b>					
Alabama .....	5,349	49.5	5.3	3.3	2.6
Florida .....	3,457	45.2	4.3	6.5	5.1
Georgia .....	6,656	43.2	1.9	2.2	3.6
South Carolina .....	2,640	52.2	4.9	2.5	4.0
<b>Delta</b>					
Arkansas .....	5,895	58.0	2.3	5.4	2.0
Louisiana .....	3,671	57.3	2.1	2.5	3.3
Mississippi .....	4,847	53.5	1.6	2.9	3.6
<b>Southern Plains</b>					
Oklahoma .....	8,151	62.0	8.6	1.8	2.1
Texas .....	21,461	54.1	7.4	2.3	5.2
<b>Mountain</b>					
Arizona .....	983	53.6	4.1	(NA)	13.3
Colorado .....	5,014	49.7	4.4	3.2	3.2
Idaho .....	3,698	52.6	3.1	4.0	7.2
Montana .....	5,874	47.9	5.7	2.9	2.6
Nevada .....	508	50.6	5.6	(NA)	15.2
New Mexico .....	2,586	50.4	7.1	9.4	6.1
Utah .....	2,558	55.4	6.3	6.3	12.2
Wyoming .....	2,284	52.2	8.9	9.4	9.1
<b>Pacific</b>					
California .....	5,461	51.0	3.4	17.6	9.2
Hawaii .....	511	52.6	5.4	5.0	25.7
Oregon .....	3,733	53.4	4.7	3.9	9.6
Washington .....	3,383	50.5	3.8	4.3	11.3
United States .....	245,324	50.3	(NA)	(NA)	(NA)

(NA) Not available.

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- Cornell’s Mann Library has launched a new website housing NASS’s and other agency’s archived reports. The new website, <https://usda.library.cornell.edu>. All email subscriptions containing reports will be sent from the new website, <https://usda.library.cornell.edu>. To continue receiving the reports via e-mail, you will have to go to the new website, create a new account and re-subscribe to the reports. If you need instructions to set up an account or subscribe, they are located at: <https://usda.library.cornell.edu/help>. You should whitelist [notifications@usda-esmis.library.cornell.edu](mailto:notifications@usda-esmis.library.cornell.edu) in your email client to avoid the emails going into spam/junk folders.

For more information on NASS surveys and reports, call the NASS Agricultural Statistics Hotline at (800) 727-9540, 7:30 a.m. to 4:00 p.m. ET, or e-mail: [nass@usda.gov](mailto:nass@usda.gov).

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