



National Hemp Report Methodology and Quality Measures

Released April 14, 2022, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA).

Scope and Purpose: The Hemp Acreage and Production Survey (AP) is a survey conducted under an agreement with the Agricultural Marketing Service (AMS) and collects information on the total planted and harvested area, yield, production, and value of hemp by utilization in the United States. The survey provides critical data about the hemp industry to assist producers, regulatory agencies, state governments, processors, and other key industry entities. As defined in the Agricultural Improvement Act of 2018 (2018 Farm Bill), the term “hemp” means the plant species *Cannabis sativa* L. and any part of the plant such as the seeds, all derivatives, and extracts, whether growing or not, with a delta-9 tetrahydrocannabinol (THC) concentration of not more than 0.3% on a dry weight basis. The Domestic Hemp Production Program, established in the 2018 Farm Bill and administered by AMS, allows for the cultivation of hemp under certain conditions. In 2021, twenty-seven States (DE, FL, GA, HI, IN, IA, KS, LA, MD, MA, MI, MN, MS, MO, NE, NV, NH, NJ, OH, OK, PA, RI, SC, SD, TX, WA, and WY) and all Native American Tribes operated under the regulations of the 2018 Farm Bill. Twenty-two States (AL, AK, AZ, AR, CA, CO, CT, IL, KY, ME, MT, NM, NY, NC, ND, OR, TN, UT, VT, VA, WV, and WI) followed the regulations of the 2014 Farm Bill which was administered by the respective state governments. Idaho did not have a regulated hemp growing program in 2021 but producers could obtain a license and grow hemp in a neighboring State. The target population for the Hemp AP Survey is all growers in the United States who are licensed to grow hemp in 2021 under the 2014 or 2018 Farm Bill. The survey is administered in all 50 States.

Timeline: For 2021, data collection began with the mailing of questionnaires in mid-October. Telephone follow up with nonrespondents began in late October and concluded in early December. Analysis, summarization, and the establishment of estimates were completed in December, January, and early February. The publication was released on February 17, 2022.

Sampling: The sampling frame is comprised of two independent frames to enable a measure of coverage. The first sampling frame contains all farm operations potentially growing hemp on the NASS list frame which was constructed from lists from AMS and other USDA agencies, lists obtained by Regional Field Offices (RFO), and normal NASS list building efforts. The second sampling frame is a web-scraped list of potential licensed hemp growers. Stratification is based on the following criteria: sampling entity on one or both sampling frames, list building source, and active or potential farm operation. For 2021, a stratified sample of 20,501 growers was selected from the union of the two sampling frames. The portion of the sample from the NASS list frame was 16,557 operations while the remaining portion (3,944) was selected from the web-scraped frame.

Data Collection: NASS in cooperation with AMS and other USDA agencies developed the Hemp Acreage and Production questionnaire. During questionnaire development, NASS survey methodologists conduct cognitive interviews, and updates are made based on cognitive testing results. Mail, web, and telephone interview modes of data collection are utilized for the survey. All sampled operations are mailed a questionnaire and instructions to complete the survey on the internet. A postcard reminder is mailed after the first week of data collection to those who have not responded, and then telephone follow up begins with any remaining nonrespondents. NASS promotes the survey online and emphasizes the importance of survey response.

All federal data collections require approval by the Office of Management and Budget (OMB). NASS must document the public need for the data, apply sound statistical practice, prove the data does not already exist elsewhere, and ensure the public is not excessively burdened. The 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 saying that response to the survey is voluntary and not required by law.

Survey Edit: As survey data are collected and captured, they are edited for consistency and reasonableness using automated systems. The edit logic also ensures administrative coding follows the methodological rules associated with the survey design. Relationships between data items (i.e., responses to individual questions) on the current survey are verified. Records that do not pass the edit logic are either updated or certified by an analyst as accurate. In some cases, respondents are re-contacted to verify unusual survey responses.

Analysis Tools: Edited data are analyzed through a standard interactive analysis tool which displays data for all reports by item. The tool provides scatter plots, tables, charts, and special tabulations that allow the analyst to compare record level data of similar records. Atypical responses, unusual data relationships, and statistical outliers for all items are revealed by the analysis tool. RFO and Headquarters 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 error is present in any survey process. This error includes reporting, recording, and editing errors, as well as nonresponse error. Steps are taken to minimize the impact of these errors, such as questionnaire testing, comprehensive interviewer training, validation and verification of the processing systems, application of detailed computer edits, and evaluation of the data via the analysis tool.

Weighting Methodology: Response to the Hemp AP 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. Post-survey weight adjustments are used to adjust for nonresponse. A logistic regression model is used to estimate expected probabilities of response. The predictors in the model are geographic region, Farm Bill state groups previously described, list building source, and farm status indicator on the NASS list frame. The inverse of the expected probability of response for each respondent becomes the nonresponse weight adjustment.

In this study, two independent lists are used in combination to create the final sampling frame. However, neither list is guaranteed to be a complete list of all hemp growing operations in the United States (otherwise called undercoverage). Therefore, a coverage adjustment is calculated for the NASS list to correct for undercoverage. A probability of coverage is calculated from the survey responses from the web-scraped portion of the sample. Weighting classes by the size of area planted and harvested are used to estimate the probability of list overlap in the NASS sample. The final weight is composed of the product of the sampling weight, nonresponse adjustment, and coverage adjustment.

From this coverage analysis, the NASS list frame for the States following the 2018 Farm Bill was found to be complete for the 2021 survey. At the National level, approximately 8% of hemp farms were estimated as missing from the NASS list frame. Missing hemp farms were primarily small operations and have been accounted for using the coverage adjustment described in the previous paragraph. Of those that responded to the survey from the NASS list portion of the sample, approximately 24% reported growing hemp in 2021. Approximately 1% of the web-scraped portion of the sample reported growing hemp in 2021.

Estimation: When all samples are accounted for, all responses fully edited, and the analysis material is reviewed, State and National summaries are executed in Headquarters. The summary results provide multiple point estimates and corresponding standard errors for each data series being estimated. It also provides information used to assess the performance of the current survey and evaluate the quality of the survey results, such as strata level expansions, response rates, and percent of the expansion from usable reports.

Information obtained from the survey along with Federal and State administrative data is used to establish estimates of total planted and harvested acres, yield, production, price, and value by utilization. These National and State level estimates are reviewed by the Agricultural Statistics Board (ASB) for errors, reasonableness, and consistency. To be considered, the administrative data must be deemed reliable and come from an unbiased source.

All hemp estimates are subject to revision the following year based on a thorough review of all available data. Estimates will also be reviewed following the 5-year Census of Agriculture, which is an exhaustive data collection effort of all

known farm operations across the United States. The information gathered from the Census of Agriculture provides the last chance for revision.

Quality Metrics for National Hemp Report

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 nonsampling error. The Hemp AP Survey CVs measure the error due to sampling as well as some nonsampling error. Nonsampling error is also evaluated by examining survey response rates and the weighted item 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 above sample that completed the survey, excluding those operations that did not have the item of interest or were out of business at the time of data collection. This calculation follows Guideline 3.2.2 of the OMB Standards and Guidelines for Statistical Surveys (September 2006).

Weighted item response rate is a ratio of reported survey data expanded by the original sampling weight compared to final nonresponse adjusted summary totals.

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.

Hemp Survey Sample Size and Response Rate - States and United States: 2021

State	Sample Size	Response Rate
	2021 (number)	2021 (percent)
Alaska	(D)	(D)
Arizona	213	74.4
Arkansas	211	68.3
California	645	57.3
Colorado	967	68.1
Connecticut	161	66.5
Delaware	35	67.6
Florida	1,264	57.1
Georgia	248	62.3
Hawaii	100	60.2
Idaho	23	-
Illinois	566	71.8
Indiana	286	68.3
Iowa	125	71.4
Kansas	235	67.4
Kentucky	1,124	78.0
Louisiana	(D)	(D)
Maine	168	73.5
Maryland	153	84.9
Massachusetts	160	77.2
Michigan	307	64.1
Minnesota	579	69.0
Mississippi	302	82.6
Missouri	283	71.4
Montana	532	76.1
Nebraska	135	73.3
Nevada	242	44.2
New Hampshire	(D)	(D)
New Jersey	134	68.7
New Mexico	211	62.4
New York	597	57.9
North Carolina	1,174	69.1
North Dakota	134	81.5
Ohio	397	43.9
Oklahoma	773	63.5
Oregon	991	60.3
Pennsylvania	732	64.2
Rhode Island	(D)	(D)
South Carolina	410	55.4
South Dakota	31	83.3
Tennessee	1,787	54.3
Texas	1,330	55.1
Utah	246	91.4
Vermont	200	67.0
Virginia	662	53.0
Washington	403	58.5
West Virginia	273	77.1
Wisconsin	422	64.8
Wyoming	42	78.6
Other States ¹	300	71.6
United States	20,501	64.0

- Represents zero.

(D) Withheld to avoid disclosing data for individual operations.

¹ Includes data withheld above.

Quality Metrics for Hemp Grown in the Open Area Planted - States and United States: 2021

State	Weighted Item Response Rate	Coefficient of Variation
	2021 (percent)	2021 (percent)
Alabama	54.8	49.0
Alaska	(D)	(D)
Arizona	67.7	55.6
Arkansas	72.2	73.4
California	55.3	42.7
Colorado	71.8	26.1
Connecticut	66.8	25.0
Delaware	71.2	65.5
Florida	58.6	16.9
Georgia	58.1	26.8
Hawaii	68.3	57.3
Idaho	-	-
Illinois	69.0	36.3
Indiana	57.6	55.3
Iowa	70.2	36.7
Kansas	75.7	44.4
Kentucky	68.8	28.7
Louisiana	(D)	(D)
Maine	68.1	42.7
Maryland	72.1	33.2
Massachusetts	67.8	51.3
Michigan	55.5	39.5
Minnesota	69.2	36.8
Mississippi	77.3	25.9
Missouri	73.4	56.6
Montana	67.5	40.9
Nebraska	75.3	66.5
Nevada	41.9	58.3
New Hampshire	(D)	(D)
New Jersey	67.6	30.9
New Mexico	67.5	41.5
New York	58.9	51.0
North Carolina	66.4	47.6
North Dakota	79.2	48.8
Ohio	57.0	15.9
Oklahoma	59.2	75.5
Oregon	58.4	28.2
Pennsylvania	67.2	70.5
Rhode Island	(D)	(D)
South Carolina	56.9	35.9
South Dakota	77.9	51.2
Tennessee	54.7	25.8
Texas	57.0	41.3
Utah	69.2	91.4
Vermont	56.5	58.2
Virginia	65.8	47.1
Washington	62.1	62.6
West Virginia	64.6	25.1
Wisconsin	67.6	42.1
Wyoming	62.3	95.5
Other States ¹	72.5	47.9
United States	62.6	11.9

- Represents zero.

(D) Withheld to avoid disclosing data for individual operations.

¹ Includes data withheld above.

Quality Metrics for Industrial Hemp Grown Under Protection Area in Production - States and United States: 2021

State	Weighted Item Response Rate	Coefficient of Variation
	2021 (percent)	2021 (percent)
Alabama	54.0	43.3
Alaska	(D)	(D)
Arizona	68.4	74.2
Arkansas	69.5	59.9
California	57.6	54.1
Colorado	71.4	80.7
Connecticut	67.2	71.9
Delaware	(D)	(D)
Florida	58.0	40.6
Georgia	58.1	43.6
Hawaii	68.3	56.4
Idaho	-	-
Illinois	70.3	49.5
Indiana	56.0	81.2
Iowa	(D)	(D)
Kansas	73.5	29.6
Kentucky	67.8	29.9
Louisiana	77.2	31.7
Maine	-	-
Maryland	72.9	64.6
Massachusetts	66.3	68.4
Michigan	55.3	34.9
Minnesota	68.6	24.8
Mississippi	76.7	56.4
Missouri	73.4	29.4
Montana	69.2	71.1
Nebraska	74.4	52.6
Nevada	41.9	47.7
New Hampshire	(D)	(D)
New Jersey	(D)	(D)
New Mexico	67.5	47.5
New York	61.9	92.0
North Carolina	63.7	23.7
North Dakota	(D)	(D)
Ohio	54.5	21.1
Oklahoma	56.5	56.9
Oregon	56.8	26.1
Pennsylvania	65.8	23.6
Rhode Island	(D)	(D)
South Carolina	56.4	31.8
South Dakota	-	-
Tennessee	53.1	32.9
Texas	56.1	59.7
Utah	69.0	34.1
Vermont	56.4	90.2
Virginia	62.6	38.2
Washington	61.9	49.8
West Virginia	63.9	34.4
Wisconsin	(D)	(D)
Wyoming	(D)	(D)
Other States ¹	66.9	57.6
United States	61.0	19.7

- Represents zero.

(D) Withheld to avoid disclosing data for individual operations.

¹ Includes data withheld above.

Information Contacts

Process	Unit	Telephone	Email
Estimation	Crops Branch	(202) 720-2127	HQ_SD_CB@usda.gov
Data Collection	Survey Administration Branch	(202) 690-4847	HQ_CSD_SAB@usda.gov
Questionnaires	Data Collection Branch	(202) 720-6201	HQ_CSD_DCB@usda.gov
Sampling and Editing	Sampling, Editing, and Imputation Methodology Branch	(202) 690-8141	HQ_CSD_SB@usda.gov
Analysis and Estimators	Summary, Estimation, and Disclosure Methodology Branch	(202) 690-8141	HQ_SD_SMB@usda.gov
Dissemination	Data Dissemination Office	(202) 720-3869	HQSDOD@usda.gov
Media Contact and Webmaster	Public Affairs Office	(202) 720-2639	HQOAPAO@usda.gov

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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.

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