Appendix A.
Census of Agriculture Methodology

The purpose of a census is to enumerate all objects with a defined characteristic. For the census of agriculture, that goal is to account for "any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year." To do this, NASS creates a Census Mail List (CML) of agricultural operations that potentially meet the farm definition, collects agricultural information from those operations, reviews the data, corrects or completes the requested information, and combines the data to provide information on the characteristics of farm operations and farm producers at the national, State, and county levels. In this appendix, these census processes are described.

THE CENSUS POPULATION

The Census Mail List

The National Agricultural Statistics Service (NASS) maintains a list of farmers and ranchers from which the CML is compiled. The goal is to build as complete a list as possible of agricultural places that meet the farm definition. The CML compilation begins with the list used to define sampling populations for NASS surveys conducted for the agricultural estimates program. Each record on the list includes name, address, telephone number, and email plus additional information that is used to efficiently administer the census of agriculture and agricultural estimates programs.

NASS builds and improves the list on an ongoing basis by obtaining outside source lists. Sources include State and federal government lists, producer association lists, seed grower lists, pesticide applicator lists, veterinarian lists, marketing association lists, and a variety of other agriculture-related lists. NASS also obtains special commodity lists to address specific list deficiencies. These outside source lists are matched to the NASS list using record linkage programs. Most names on newly acquired sources are already on the NASS list. Records not on the NASS list are treated as potential farms until NASS can confirm their existence as a qualifying farm. Staff in NASS regional and field offices routinely contact these potential farms to determine whether they meet the farm definition. For the 2022 Census of Agriculture, NASS made a concerted effort to work with community-based organizations not only to improve list coverage for minorities but also to increase census awareness and participation.

List building activities for developing the 2022 CML started in 2019 by updating list information from respondents to the 2017 Census of Agriculture. Between 2017 and 2022, NASS conducted a series of National Agricultural Classification Surveys (NACS) on over 2.1 million records, which included nonrespondents from the 2017 census and newly added records from outside list sources. The NACS report forms collected information that was used to determine whether an operation met the farm definition. If the definition was met, the operation was added to the NASS list and subsequently to the CML. Addressees that were nonrespondents to a NACS were also added to the CML and identified with a special status code.

Measures were taken to improve name and address quality. Additional record linkage programs were run to detect and remove duplicate records both within each State and across States. List addresses were processed through software programs that utilize the United States Postal Service's National Change of Address System and the Locatable Address Conversion System to improve mail delivery. Records on the list with missing or invalid phone numbers were matched against a nationally available telephone database to obtain as many phone numbers as possible. To reduce costs, operations with characteristics that indicated they were unlikely to be farms, according to the farm definition, were removed from the list.

The official CML for the 2022 Census of Agriculture was established on September 3, 2022. The list contained 2,879,343 records. Of these, 2,079,333 records were thought to meet the NASS farm definition and 800,010 were potential farm records, which included NACS nonrespondents, other records added to the CML by the NASS regional field offices after the record linkage process, and late adds to the CML that were not included in any previous NACS or State screening survey.

Not on the Mail List (NML)

Extensive efforts are directed toward developing a CML that includes all farms in the U.S. However, some farms are not on the list, and some agricultural operations on the list are not farms. NASS uses its June Area Survey (JAS) to

quantify the number and types of farms not on the CML. The records in the JAS that are not on the CML are said to be in the Not-on-the-Mail List (NML) domain. If a JAS record in the NML domain is determined to be a farm during the census, it is an NML farm. The NML farms are used to measure coverage associated with the grown crops, farm numbers, and inventories of cattle. Sampled segments in the JAS are personally enumerated. Each operation identified within a segment boundary is known as a tract.

The 2022 JAS sample was increased to improve the farm counts for operations that produced specialty commodities or had socially disadvantaged or minority producers. The total JAS sample consisted of 14,015 segments of which 4,933 were additional ACES segments. This set of additional segments is referred to as the Agricultural Coverage Evaluation Survey (ACES) segments. The ACES segments were selected using a multivariate sampling design that targeted specific items at the U.S. level. The 2022 JAS consisted of sample segments from all States, with the exception of Alaska where NASS does not maintain an area frame.

During the JAS/ACES enumeration process, each tract is identified as either agricultural or non-agricultural. Each JAS/ACES agricultural tract is identified as a farm or non-farm in June based on the farm definition of $1,000 of sales or potential sales of agricultural products. Non-agricultural tracts are further classified into categories: with farm potential, with unknown farm potential, or with no farm potential. The names and addresses collected in the 2022 JAS/ACES were matched to the CML. Those from the 2022 JAS/ACES that did not match were determined to be in the NML domain and sent a yellow census report form so that they could be differentiated from the green report form sent to those addressees on the CML. Instructions on the census report form directed any respondent who received duplicate forms to complete the CML form and to mail all duplicate forms back together. Those who returned a CML and an NML form had been misclassified as NML and were removed from the NML domain.

The initial NML mailout consisted of 41,273 records. A total of 40,775 NML records were analyzed, of which 1,913 records were confirmed to be NML and in-scope.

The farm/nonfarm status of each NML domain operation was determined based on the reported data in the census form. An operation in the NML domain that was determined to be a farm is referred to as an NML farm. Characteristics of NML farms and their producers provided a measure of the undercoverage of farms present in the CML.

The percentage of farms not represented on the CML varied by State. In general, NML farms tended to be small in acreage, production, and sales of agricultural products. Farm operations were missing from the CML for various reasons, including the possibility that the operation started after development of the CML, the operation was so small that it did not appear in any agriculture-related source list, or the operation was misclassified as a nonfarm prior to census mailout. The CML was used with the NML in a capture-recapture framework to represent all farming operations across all States in the JAS sample.

DATA COLLECTION OUTREACH AND PROMOTIONAL EFFORTS

NASS planned and executed a multi-phase strategic communications campaign for the 2022 Census of Agriculture, to increase the level of awareness and response among all U.S. agricultural producers.

- Phase 1 ran from April 2021 − June 2022. It raised awareness about the census and list building, encouraged producers to sign up in response to NASS mailings and at community, association, and other stakeholder meetings where NASS partners reached out.

- Phase 2 ran from July 2022 − October 2022. It notified farm producers and agricultural organizations that the census would be mailed in November and encouraged communications regarding the census.

- Phase 3 ran from November 2022 – May 2023. It focused on census data collection with messaging urging response to remind producers that it was not too late to respond.

- Phase 4 ran from August 2023 – February 2024. It thanked producers for their participation and NASS partners for their support and informed everyone of the February 2024 data release plan.

The communications campaign focused on these primary areas: partnership building, local-level outreach, public relations, media relations, paid media, social media and some paid advertising. Some external support was provided by a private communications agency (i.e. primarily assisted with design and paid advertising).

The unifying force behind the 2022 communications campaign was the theme “Your Voice. Your Future. Your Opportunity.” This was accompanied by supporting messages and artwork that created a consistent look and feel for all census communications. All messages and materials served the purpose of inspiring action: Sign Up to Be Counted - Show the Value of Your Work - *Grow Your*

Farm Future - Shape Farm Policy/Programs - Respond to the Census of Agriculture - Be counted - The Census of Agriculture is Your Voice, Your Future, Your Opportunity.

Partnership and Local-Level Outreach

At the national level, NASS officials met with leaders from dozens of agricultural organizations, State Departments of Agriculture, and other USDA agencies to successfully secure their support in promoting the census among their constituencies. Stakeholders partnered with NASS to promote the 2022 Census of Agriculture through publications (e.g. newsletters), special mailings, speeches, social media, websites, and other communications. In addition, through grassroots-level outreach and efforts, NASS partnered with a number of community-based organizations to reach minority and limited-resource farmers and ranchers. National-level outreach was encouraged and mirrored at the regional, State, and local levels. Among the highlights of these partnership efforts was the production of multiple television and radio public service announcements featuring the U.S. Secretary of Agriculture, State secretaries, directors, and commissioners of agriculture and leaders from community-based organizations.

Coverage of American Indian and Alaska Native Farm Producers

To maximize coverage of American Indian and Alaska Native agricultural producers, special procedures were followed in the census. A concerted effort was made to get individual reports from every American Indian and Alaska Native farm or ranch producer in the country. If this was not possible within some reservations, a single reservation-level census report was obtained from knowledgeable reservation officials. These reports covered agricultural activity on the entire reservation. NASS staff reviewed these data and removed duplication with any data reported by American Indian or Alaska Native producers who responded on an individual census report form. Additionally, NASS obtained, from knowledgeable reservation officials, the count of American Indian and Alaska Native producers (on reservations) who were not counted through individual census report forms, but whose agricultural activity was included in the reservation-level report form.

Table D, **American Indian and Alaska Native Producers:** 2022 provides the number of producers (1) reported as American Indian or Alaska Native in the race category, either as a single race or in combination with other races, on the individual census report forms (for up to four per farm) and (2) identified as American Indian or Alaska Native producers farming on reservations by reservation officials. The count from the individual report forms is summarized in the "Individually reported" column. It includes up to four producers on or off reservations. The "Other" column provides counts of producers on reservations as reported by a reservation or tribal official. The "Total" column is simply a sum of the "Individually reported" and the "Other" columns. Tables in other parts of the publication count the reservation-level reports as single farms.

Public Relations

In the public relations arena, NASS worked with internal and external, national, regional, and local stakeholders to equip them with communications tools and resources to deliver the census communications message to their audiences. NASS utilized its Intranet, the Partner Tools section on the census webpage, and a regularly scheduled, newsletter-type email update to deliver materials to staff across its 12 regions, other USDA agencies and external stakeholders. The materials included but were not limited to: customizable news releases, public service announcement scripts, and a PowerPoint template; Secretary of Agriculture video public service announcements, and drop-in advertisements; informational, instructional, and testimonial videos; website buttons and banners; brochures in multiple languages; social media posts; flyers; posters; FAQ sheets, talking points, and more. In addition, at the national level, NASS issued six news releases during data collection (three more were produced before data collection to inform and prepare producers) citing department and agency spokespeople, published half a dozen timely and relevant pieces to the USDA blog highlighting the census, and conducted three social media campaigns. These public relations efforts at the national and local-levels helped ensure that NASS' message about the census was continually in the media, including print and online publications, a variety of social media, radio, and some television programs. Media outlets included both those specializing in agriculture and more general outlets.

Paid Media

With a very limited budget, NASS was able to apply a small portion of funds toward paid advertising. For the 2022 Census of Agriculture, NASS strategically advertised in regional print publications, online, and with national agriculture news services (i.e., TV, radio) to bolster reach both in general and within geographically specific, previously under-represented populations and lower response areas.

DATA COLLECTION

Method of Enumeration

Data collection was accomplished primarily by mail, Computer-Assisted Self Interview (CASI) on the Internet, and personal enumeration for special classes of records in the census operations. Personal enumeration (interviewing) involved the use of both Computer-Assisted Telephone Interview (CATI) and Computer-Assisted Personal Interview (CAPI) data collection instruments. Enumerators at the five NASS Data Collection Centers conducted CATI data collection. In addition, enumerators under contract with NASS through the National Association of State Departments of Agriculture (NASDA) conducted phone and personal interviews with respondents. For the 2022 Census of Agriculture, NASS implemented a pre-notification strategy to increase awareness, improve overall responses, and encourage respondents to report early to avoid continued correspondence. All records with an e-mail address received an e-mail message marketing the improved web form and announcing the census mail packets were coming.

Report Forms

Four versions of report forms were used for the 2022 Census of Agriculture:

- General form (22 - A100)
- Hawaii form (22 - A101)
- American Indian form (22 - A300)
- Farm Status form (22 - A400)

The general form facilitated reporting crops and livestock most commonly grown and raised in the U.S. The short form expedited reporting specific crops or livestock for pre-identified farms and ranches in the U.S. The Hawaii form targeted crops and livestock specifically grown or raised on farms and ranches in Hawaii. The American Indian form focused on crops and livestock for farms and ranches on reservations in Arizona, New Mexico, and Utah. All report forms allowed respondents to write in specific commodities that were not prelisted on their report form.

Report Form Mailings

Census data collection began on November 22, 2022. Nearly all producers on the CML received a letter inviting them to report online. They received a unique survey code and instructions for completing their census online. The letter encouraged producers to report online early to avoid receiving mail and phone follow-up. Approximately 3 million mail packets were mailed in December 2022. Each packet contained a cover letter, instruction sheet, a labeled report form, and a return envelope. The Census Bureau's National Processing Center (NPC) in Jeffersonville, IN was contracted to perform mail packet preparation, initial mailout, and two follow-up mailings to nonrespondents.

The initial mailout was followed by a thank-you reminder correspondence in January 2023. This pressure-sealed envelope reminded respondents of the approaching deadline and that they could report online. First follow-up mail packets were mailed in mid-February 2023 to approximately 1.5 million nonrespondents. Second follow-up mail packets were mailed in mid-March 2023 to approximately 1 million nonrespondents. A final mailing went to approximately 800,000 non-respondents. This mailing included a drastically reduced four-page questionnaire designed to primarily determine if the operation was a farm or not in business.

Nonresponse Follow-up

Operating concurrently with NPC's mail data collection efforts, NASS Data Collection Centers targeted selected groups of census nonrespondents for telephone enumeration. NASS regional field offices targeted selected groups of census nonrespondents for in-person enumeration. These efforts were referred to as:

- Must Case Follow-up
- American Indian Producer Follow-up
- National Nonresponse Follow-up
- Not on Mail List (NML) Follow-up

Must Case Follow-up. Must cases are known large or unique operations, the absence of which could have significantly affected the accuracy of census results. For the 2022 Census of Agriculture, 125,697 records were categorized as Must cases. Each active Must operation was accounted for by mail receipt, phone interview, or personal enumeration; if an operation was no longer in business, its nonfarm status was documented. Call centers conducted CATI calling of nonrespondent Must cases from March 2023 through May 2023, after the initial and first follow-up mailings. Following the CATI calling, the remaining nonresponse Must cases were assigned to regional field offices for personal enumeration. Because of the potential importance of Must cases, they were all accounted for and therefore not eligible for nonresponse weighting adjustment.

American Indian Producer Follow-up. The American Indian report form (22-A300) was mailed to all operations in Arizona, New Mexico and Utah thought to have an American Indian producer. It was included in the initial

mailout, but due to poor mail response, a personal enumeration data collection strategy was utilized with no additional mail follow-up. A concerted effort was made to get individual reports from every American Indian farm producer in the country. If this was not possible within a reservation, a single reservation-level census report was obtained from knowledgeable reservation officials. These reports covered agricultural activity on the entire reservation. NASS staff reviewed these data and removed any duplicate data reported by American Indian producers from that reservation who responded on an individual census report form. Additionally, NASS obtained, from knowledgeable reservation officials, the count of American Indian farm producers (on the reservations) who were not counted through individual census report forms, but whose agricultural activity was included in the reservation-level report form.

National Nonresponse Follow-up (Excludes Must Records). In April 2023, a group of records that were not part of other nonresponse data collection efforts were identified for additional phone contacts. In total, 82,237 records with specified demographics and/or eligibility for Census Special Studies (follow-ons) were made available for nonresponse Computer-Assisted Telephone Interviews (CATI).

Not-on-the-Mail List (NML) Follow-up. To account for farming operations not on the CML, NASS used its 2022 JAS sample from the NASS area frame, augmented with the ACES segments. Because the NASS area frame covers all land in the U.S. with the exception of Alaska, it includes all farms. As previously described, NASS conducted a record linkage operation between the CML records and the records from the 2022 JAS/ACES. Those 2022 JAS records that did not match records on the CML were designated as "Not-on-the-Mail List" (NML) records. These records were mailed a yellow census form so that it could be differentiated from the green forms mailed to CML records. The NML records were mailed at the same time as the census mailing and received the same follow-up procedures as the census mailing through the first follow-up in mid-February 2023. Beginning in March 2023, CATI was used for nonresponse follow-up for NML nonrespondents.

REPORT FORM PROCESSING

Data Capture

The Census Bureau's National Processing Center (NPC) in Jeffersonville, IN was contracted to process returned mail packets. NASS staff on site at the NPC provided technical guidance and monitored NPC processing activities. All report forms returned to the NPC were immediately checked in, using bar codes printed on the mailing label, and removed from follow-up report form mailings. All forms with any data were scanned and an image was made of each page of a report form. Optical Mark Recognition (OMR) was used to capture categorical responses and to identify the other answer zones in which some type of mark was present.

Data entry operators keyed data from the scanned images using OMR results that highlighted the areas of the report forms with respondent entries. The keyer evaluated the contents and captured pertinent responses. Ten percent of the captured data were keyed a second time for quality control. If differences existed between the first keyed value and the second, an adjudicator handled resolution. The decision of the adjudicator was used to grade the performance of the keyers, who were required to maintain a certain accuracy level.

The images and the captured data were transferred to NASS's centralized network and became available to NASS analysts on a flow basis. The images were available for use in all stages of review.

Editing Data

Captured data were processed through a computer formatting program that verified that records were valid – that the record ID number was on the list of census records, that the reported counties of operation and production were valid, and other related criteria. Rejected records were referred to analysts for correction. Accepted records were sent to a complex computer batch edit process. Each execution of the computer edit in batch mode consisted of records from only one State and flowed as the data were received from NPC, the NASS Computer-Assisted Self Interview (CASI), or the Computer-Assisted Telephone Interview (CATI) applications.

The computer edit determined whether a reporting operation met the qualifying criteria to be counted as a farm (in-scope). The edit examined each in-scope record for reasonableness and completeness and determined whether to accept the recorded value for each data item or take corrective action. Such corrective actions included removing erroneously reported values, replacing an unreasonable value with one consistent with other reported data, or providing a value for an item omitted by the respondent. To the extent possible, the computer edit determined a replacement value. Strategies for determining replacement values are discussed in the next section. Operations failing to meet the qualifying criteria for being classified as a farm were categorized as out-of-scope for the census. Records that NASS had reason to believe might have been erroneously classified as out-of-

scope (indications of recent and/or significant agricultural activity reported on NASS surveys, for example) were referred to analysts for verification.

The edit systematically checked reported data section-by-section with the overall objective of achieving an internally consistent and complete report. NASS subject-matter experts had previously defined the criteria for acceptable data. Problems that could not be resolved within the edit were referred to an analyst for intervention. Prior to the census mail-out, NASS established a group of analysts in a Census Editing Unit in the National Operations Center in St. Louis, MO who examined the scanned images, consulted additional sources of information, and determined an appropriate action. Regional field office analysts also participated using an interactive version of the edit program to submit corrected data and immediately re-edit the record to ensure a satisfactory solution.

Farm Status Form Editing

From the CML, 883,732 records were selected to receive a Farm Status form as a final follow-up form; this form was derived from the full census report form by selecting a subset of the questions on the full form. Since these questions were also asked on the general form, the edit was able to treat the Farm Status form responses as though they were incomplete general forms, as described in the previous paragraphs.

Imputing Data

The edit determined the best value to impute for reported responses that were deemed unreasonable and for required responses that were absent. If an item could not be calculated directly from other current responses, the edit determined whether acreage, production, or inventory items had been reported for that farm on a recent NASS crop or livestock survey. For producers who had not changed in five years, demographics such as race and gender were taken from the previous census. Administrative data from the Farm Service Agency were used for a few items, such as Conservation Reserve Program acreage. When deterministic edit logic and previously-reported data sources were unable to provide a current value, data from a reporting farm of similar type, size, and location were considered. In cases where automated imputation was unable to provide a consistent report, the record was referred to an analyst for resolution.

Separate system processes were established to efficiently provide data from a similar farm to the edit when donor imputation was required. The farm characteristics used to define similarity between a recipient record and its donor record were determined dynamically by the edit logic. Euclidean distance was used for similarity computations, with each contributing similarity characteristic scaled appropriately. The most similar farm based on this criterion (the "nearest neighbor") was identified and returned to the edit for use as a donor. The calculated distance between the centroids of the principal counties of production of the donor and recipient was always included as one of the measures of similarity.

To provide donors to the automated edit, a pool of successfully edited records was maintained for each section of the report form. These donor pools began with 2017 census data, reconfigured to emulate 2022 data and then edited using 2022 logic. Data from the 2020 Census Content Test were similarly remapped and edited before being added to the original donor pools. As 2022 records were successfully processed, they were added to the donor pools, which maintained the most recent data for each farm. Donor pools were updated approximately every other week, as determined by edit processing schedules. After several updates, all initial data records were dropped, leaving only 2022 records in the donor pools. After each update, donor pool records were grouped into strata containing farms in the same State of similar type and size, using a data-driven algorithm to define strata. Certain American Indian farms were treated as a separate group, effectively having their own donor pool.

In response to each donor request issued by the edit, a dedicated system process would search the appropriate stratum and respond with the most similar donor, while giving preference to more recent donors. In relatively rare instances where it was unable to provide a donor, the donor selection process issued an appropriate failure message to the edit. Imputation failures occurred for several different reasons. The requirement that an imputed value be positive could have ruled out all available donors, as could have the necessity for the donor record to satisfy a particular constraint – say, that the donor record has cattle, but no milk cows. In general, an imputation failure occurred if there were no satisfactory donors in the same profile as the report being edited. Records with imputation failures were either held until more records were available in the donor pool or referred to an analyst. In addition, when such a failure occurred in finding a donor for expenditure data, donor pool averages were provided in lieu of an individual donor, wherever possible. This "failover" utility was first introduced for the 2012 census imputation process, and significantly reduced the number of imputation failures among the expenditure and labor variables. During the early stages of editing, records requiring imputation for production (and hence yields) of field crops or hay, land values, or certain expenditure variables, were set aside or "parked." These records were edited when the donor pools contained only 2022 records, ensuring that 2022 data were

used in the imputations for the variables.

After receiving a donor's data, the edit substituted the values into the edited record. In many cases, the donor record's data value was scaled using another data field specified in the edit logic. In such cases, the size of the auxiliary field's value in the edited record, relative to its value in the donor record, was used to appropriately scale the donor record's value for the field to be imputed. The imputed data were then validated by the same edit logic to which reported data were subject. Since imputation was conducted independently for each occurrence, reports requiring multiple imputations may have drawn from multiple donors.

As was done for the 2017 Census, for records reporting three or more persons as producers, a different imputation process was used for certain items (specifically the items in question 3) in the Personal Characteristics Section. Records with one or two persons reported as producers had these data edited and imputed using the decision logic table edit and donor pool imputation process. Records with three or more persons reported as producers, and for which it was determined that these data were inconsistent or missing, had these data imputed using a fully conditional specification method. During the edit for records reporting three or more producers, the items needing imputation were marked, and the record was flagged. At the end of the data collection period, the data for these records (both the items needing to be imputed and the other variables needed by the model) were pulled and run through the imputation program. The resulting imputed values were loaded back to the records, and the records were made available for review.

Data Analysis

The complex edit ensured the full internal consistency of the record. Successfully completing the edit did not provide insight as to whether the report was reasonable compared to other reports in the county. Analysts were provided an additional set of tools, in the form of listings and graphs, to review record-level data across farms. These examinations revealed extreme outliers, large and small, or unique data distribution patterns that were possibly a result of reporting, recording, or handling errors. Potential problems were investigated and, when necessary, corrections were made, and the record interactively edited again.

When NASS summarizes data from the census of agriculture, each individual report is typically assigned to a single “principal” county. The principal county is the county in which the majority of an operation’s agricultural products are produced, as reported by the producer. For large operations that have significant production in multiple counties, their reports may be broken up into multiple source counties to more accurately summarize the data. Similarly, for large farms operating in more than one State, separate report forms are completed by State in order to assign the proper portion of the farm’s total agricultural production to each State in which the farm operates.

ACCOUNTING FOR UNDERCOVERAGE, NONRESPONSE, AND MISCLASSIFICATION

Although much effort has been expended making the CML as complete and accurate as possible, it does not include all U.S. farm operations, resulting in list undercoverage. Additionally, some farm operations on the CML did not respond to the census, despite numerous contact attempts. Finally, although each operation was classified as a farm or a nonfarm based on their census responses, some were misclassified; that is, some nonfarms were classified as farms and some farms were classified as nonfarms. NASS’s goal is to produce agricultural census totals for publication at the county level that are fully adjusted for these factors: list undercoverage, nonresponse, and misclassification.

In 2017, NASS used a series of models based on a subset of the responding census and all the JAS records in a capture-recapture framework to separately adjust for undercoverage, nonresponse, and misclassification. For the 2022 Census of Agriculture, the capture-recapture methodology was extended to model the probability of capture with a single model, thereby allowing the utilization of all census responses and JAS records in the adjustments. To implement capture-recapture methods, two independent samples are required. The 2022 Census of Agriculture (based on the CML) and the 2022 JAS (based on the area frame) were those two samples. Historically, NASS has been careful to maintain the independence of the CML and the area frame. Thus, the Census of Agriculture and the JAS were assumed to be independent after accounting for heterogeneity in the capture probabilities based on characteristics of records.

For a farm to be identified as a farm, and thus captured by the census, it must be on the CML, respond to the census report form, and be classified as a farm on the form. Thus, the capture probability π_C is of interest:

$\pi_C = \pi(\text{CML, Responded, Farm on Census}|\text{Farm})$

Two types of classification error can occur. First, a farm can be misclassified as a nonfarm. This type of misclassification is accounted for in determining the probability of capture π_C. The second type of classification

error results when a response to the census is classified as a farm operation when it does not meet the definition of a farm. That is, some farms on the CML may be misclassified from their census report response and may be nonfarms. To account for the misclassification of nonfarms as farms, the probability of a farm on the census being classified correctly must be estimated; that is,

$\pi_{CCFC} = \pi$(Farm | Farm on Census)

where *CCFC* represents Correct Census Farm Classification. To adjust for undercoverage, nonresponse, and misclassification, each CML record classified as a farm based on its response to the census report form was given a weight of the ratio of the estimated probability of correct classification of a farm on the census and the estimated probability of capture $(\hat{\pi}_{CCFC}/\hat{\pi}_C$ where the hat symbol ($\hat{}$) denotes an estimate). To estimate the number of farms with a given set of characteristics, the weights of CML records responding as farms on the census and having that set of characteristics were summed.

This estimator is referred to as the capture-recapture estimator (*CR*):

$$CR = \sum_{i \in F} \frac{\hat{\pi}_{CCFC,i}}{\hat{\pi}_{C,i}}$$

where *F* is the set of all CML records classified as farms based on their responses to the census report form.

To estimate these probabilities $(\hat{\pi}_C$ and $\hat{\pi}_{CCFC})$, the records in the 2022 JAS sample were matched to the 2022 CML using probabilistic record linkage allowing the records only on the CML, JAS, and on both the CML and JAS to be identified. All CML records and JAS tracts were used to estimate the capture-recapture probabilities jointly.

Resolving Farm Status

The farm status based on census responses to either the CML or NML census data collection and the response on the JAS agreed in most cases; these records are referred to as having resolved farm status. However, in other cases, a record was identified as a farm (nonfarm) on the JAS and as a nonfarm (farm) on the CML or the NML. Such records are said to have conflicting or unresolved farm status. An operation identified as a farm is referred to as in-scope; an operation identified as a nonfarm is referred to as out-of-scope. From the set of matched records, two groups with conflicting farm status were identified: 1) in-scope JAS records that were out-of-scope on the census and 2) census in-scope and JAS out-of-scope records. The records with conflicting farm status were sent to NASS regional field offices for review. In each case, efforts were made to determine whether (1) the status had changed between June and December when the census was conducted, (2) the JAS farm status was correct, (3) the census farm status was correct, (4) the records were incorrectly matched, or (5) the farm status could not be resolved.

The probability that an operation is a farm was estimated for census and JAS by using a conditional logistic model. Only those records identified as a farm based on either their JAS response or their Census response were used to develop the model for estimating the probability a record is associated with a farm. Operations with matching farm status were considered as certain if the farm status agreed between the JAS and the CML. If the status between the JAS and CML was conflicting, then the operation was treated as uncertain during the modeling stages. Characteristics of the operations were considered as potential covariates in the model. Variable selection was conducted using a stepwise algorithm to maximize the conditional likelihood. The probability of being a farm is estimated for each record classified as a farm based on their JAS or census response. The estimated probability is used as a weight in all subsequent modeling.

Capture Probabilities

Recall that, for a farm to be identified as a farm, and thus captured, by the census, it must be on the CML, respond to either the census or JAS report form and, based on that response, be classified as a farm. Therefore, the probability of capture π_C may be written as

$\pi_C = \pi$(CML, Responded, Farm on Census|Farm)
$= \pi$(CML|Farm)π(Responded|CML, Farm)π(Farm on Census|CML, Responded, Farm)

Terms in the probability of capturing a farm depend on characteristics of the farm. These terms, as well as the corresponding terms associated with a farm being captured by the JAS, were jointly estimated from a single model. Using all Census and JAS data, model variables were selected by applying a stepwise variable selection algorithm and expert opinion. Estimation was based on a conditional weighted likelihood. The events of a farm being included in the CML, the JAS or both were included in the likelihood. The event of a farm not being included in either the JAS or the CML was excluded from the likelihood but was accounted for through the model's capture-recapture properties. Although the probability of capture is estimated for both CML and JAS records, only CML records with a census response are given a census weight; records with only a JAS response are not given a census weight or used further to produce census estimates.

Because Alaska is not included in the JAS and thus has no area frame, the Alaskan agricultural operations were not

included in the capture-recapture process. No adjustments were made for undercoverage or misclassification. To account for nonresponse, the CML records were divided into three groups: (1) the Must records, (2) the Criteria Records, and (3) the remaining CML records. The must records received a weight of one, thereby receiving no adjustment for nonresponse. The probability of response for each of the other two groups was the proportion of responders within the group. Each record within the group was then given a weight equal to the reciprocal of the probability of response.

Misclassification

An operation is misclassified if: (1) it meets the definition of a farm but is classified as a nonfarm on the census or (2) it does not meet the definition of a farm but is classified as a farm on the census. The first type of misclassification is accounted for when modeling the probability of capture. An adjustment is still needed for the misclassification of nonfarms as farms. As with farm status and capture, the probability of this misclassification depends on an operation's characteristics. Thus, a conditional logistic model was developed. Given that a farm on the CML was classified as a farm in the census, the probability of its being a farm was modeled based on its characteristics.

CALIBRATION

Each operation identified as being in-scope on the CML was given a weight equal to the probability of misclassifying a nonfarm as a farm on the census divided by the probability of capture. This weight accounted for undercoverage, nonresponse, and both types of misclassification.

The record weighting processes were initially applied at the State level to produce adjusted estimates of farm numbers, land in farms, and for 64 different categories of characteristics of the farm operation or the farm producer -- value of agricultural sales (10); age (2); female; race (3); Hispanic origin; 4 sales categories for each of 10 major commodities (40); and farm type groups (7). The State-level number of farms and land in farms were two additional adjusted estimates, resulting in 66 categories. To reduce the intercensal variation at the State level, the State targets were smoothed by averaging the 2022 estimates from capture-recapture and the published 2017 State estimates.

These State estimates were general purpose in that they did not provide any control over expected levels of commodity production of the individual farm operation. As a result of this limitation, the procedures could have over-adjusted or under-adjusted for commodity production. To address this, a second set of variables, known as commodity targets, was added to the calibration algorithm. These targets were commodity totals from administrative sources or from NASS surveys of nonfarm populations (e.g., USDA Farm Service Agency program data, Agricultural Marketing Service market orders, livestock slaughter data, cotton ginning data). The introduction of these commodity coverage targets strengthened the overall adjustment procedure by ensuring that major commodity totals remained within reasonable bounds of established benchmarks.

Each State was calibrated separately. The calibration algorithm addressed commodity coverage. The algorithm was controlled by the 65 State farm operation coverage targets and the State commodity coverage targets. Because calibration targets are estimates subject to uncertainty, NASS allowed some tolerance in the determination of the adjusted weights. Rather than forcing the total for each calibration variable computed using the adjusted weights to equal a specific amount, NASS allowed the estimated total to fall within a tolerance range.

To ensure that all subdomains for which NASS publishes summed to their grand total, integer weights were produced by a discrete calibration algorithm. This eliminated the need for rounding individual cell values and ensured that marginal totals always added correctly to the grand total. If a weight was initially not in the interval [1,6], it was trimmed so that it was in that interval. That is, adjusted weights less than 1 were set to 1, and those greater than 6 were set to 6. The remaining non-integer weights were then rounded sequentially to reduce the distance of the estimated totals from the targets.

Calibration adjustments began with the computation of a priority index for each record. The priority index was the absolute value of the gradient of the relative error associated with increasing or decreasing a record's weight by one. The record with the highest priority index was then selected as a candidate to increase or decrease its weight by one to reduce the cumulative distance from the targets as measured by the relative error. If the new value produced an improvement and satisfied the range restrictions, the weight was updated and new priorities were assigned; otherwise, the record with the next highest priority index was processed. This process was iteratively performed until convergence was attained. Because census data collection was assumed to be complete for very large and unique farms, their weights were set to 1 during the calibration adjustment process. For all other farms, the final census record weights were forced to be an integer number in the interval [1, 6]. The calibration process considered all targets simultaneously through the priority index. Although calibration was seldom able to adjust

weights so that all State targets were met, all targets were brought collectively as close to the targets as possible.

The proportions of selected census data items that were due to coverage, response, and classification adjustments are displayed in Tables A and C.

DISCLOSURE REVIEW

After tabulation and review of the aggregates, a comprehensive disclosure review was conducted. NASS is obligated to withhold, under Title 7, U.S. Code, any total that would reveal an individual's information or allow it to be closely estimated by the public. Farm counts are not considered sensitive and are not subject to disclosure controls. Cell suppression was used to protect the cells that were determined to be sensitive to a disclosure of information.

Based on agency standards, data cells were determined to be sensitive to a disclosure of information if they failed either of two rules. The threshold rule failed if the data cell contained less than three operations. For example, if only one farmer produced turkeys in a county, NASS could not publish the county total for turkey inventory without disclosing that individual's information. The dominance rule failed if the distribution of the data within the cell allowed a data user to estimate any respondent's data too closely. For example, if there are many farmers producing turkeys in a county and some of them were large enough to dominate the cell total, NASS could not publish the county total for turkey inventory without risking disclosing an individual respondent's data. In both of these situations, the data were suppressed and a "(D)" was placed in the cell in the census publication table. These data cells are referred to as primary suppressions.

Since most items were summed to marginal totals, primary suppressions within these summation relationships were protected by ensuring that there were additional suppressions within the linear relationship that provided adequate protection for the primary. A detailed computer routine selected additional data cells for suppression to ensure all primary suppressions were properly protected. These data cells are referred to as complementary suppressions. These cells are not themselves sensitive to a disclosure of information but were suppressed to protect other primary suppressions. A "(D)" was also placed in the cell of the census publication table to indicate a complementary suppression. A data user cannot determine whether a cell with a (D) represents a primary or a complementary suppression.

Regional field office analysts reviewed all complementary suppressions to ensure no cells had been withheld that were vital to the data users. In instances where complementary suppressions were deemed critically important to a State or county, analysts requested an override, and a different complementary cell was chosen.

CENSUS QUALITY

The purpose of the census of agriculture is to account for "any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year." To accomplish this, NASS develops a CML that contains identifying information for operations that have an indication of meeting the census definition, develops procedures to collect agricultural information from those records, establishes criteria for analyst review of the data, creates computer routines to correct or complete the requested information, and provides census estimates of the characteristics of farms and farm producers with associated measures of uncertainty.

It is not likely that either the CML includes all operations that meet the definition of a farm or that all those that do meet the definition of a farm respond to the census inquiry. The goal is to publish data with a high level of quality. The quality of a census may be measured in many ways. One of the first indicators used is a measure of the response to the census data collection as it has generally been thought that a high response rate indicates more complete coverage of the population of interest. This is a valid assumption if the enumeration list, the CML here, has complete coverage of the population of interest. In the case of the census of agriculture, the definition requiring advance knowledge of sales makes achieving a high level of coverage difficult. To ensure that the census of agriculture is as complete as possible, records are included that might not meet the census definition of a farm – in fact, almost 50 percent more records than the anticipated number of qualifying farm operations were included in the 2022 CML. A second indicator of quality then is the coverage of the farm population by the CML. Other indicators of quality relate to the accuracy and completeness of the data, and the validity of the procedures used in processing the data.

In some cases, NASS was able to produce measures of quality – such as the response rate to the data collection, the coverage of the census mail list, and the variability of the final adjusted estimates. In other cases, measures were not produced but descriptions of procedures that NASS used to reduce errors from the procedures were subsequently provided.

Census Response Rate

The response rate is one indicator of the quality of a data

collection. It is generally assumed that if a response rate is close to a full participation level of 100 percent, the potential for nonresponse bias is small, although this has been questioned in the literature. The response rate for the 2022 Census of Agriculture CML was 61.0 percent, as compared with the 2017 Census of Agriculture's response rate of 71.8 percent and 74.6 percent for the 2012 Census of Agriculture.

The 2022 Census of Agriculture's response rate used the fourth response rate formula (RR4) from the American Association of Public Opinion Research's Response Rate Standard Definitions manual:

$$RR4 = \frac{C_{adj}}{C_{adj} + R + NC + O + Replicated + e(U)}(100)$$

where
C_{adj} = number of fully and partially completed records, excluding replicated records
R = number of explicit refusals
NC = number of non-contacted operations known to be eligible
O = number of other types of nonrespondents
Replicated = number of replicated records
U = number of operations of unknown eligibility
$e(U)$ = estimated number of operations of unknown eligibility assumed to be eligible

Records were classified into the above variables based on the combination of their active status (AS) codes, in-scope status, and replication status. Active status refers to the eligibility status of records for selection on the CML. All replicated records were considered a form of nonresponse and were classified into other nonrespondents; in-scope status was considered immaterial.

Certain active status classifications indicated records of unknown agricultural status. These classifications included records to be removed from the CML but had data from outside sources indicating agricultural activity, new records from outside data sources, nonrespondents and refusals to the NACS, records for regional office handling only, and records with Farm Service Agency or Conservation Reserve Program data on operations that are not owned by the principal producer. These records were stratified (grouped) based on their probabilities of being in-scope had they responded. The estimated number of in-scope nonrespondents was calculated for the *h*th stratum (group) by the following formula:

$$e(U_h) = \left(\frac{C_{in-scope,h}}{C_h}\right)U_h$$

where
$e(U_h)$ = estimated number of operations of unknown eligibility assumed to be eligible in the *h*th group
$C_{in-scope,h}$ = the number of completed and in-scope census records in the *h*th group
C_h = the number of completed census records in the *h*th group
U_h = number of operations of unknown eligibility in the *h*th group

Census Coverage

As a side-product of the statistical adjustment used to account for undercoverage, nonresponse of farms on the CML, and misclassification of responses to the census, the proportion of the adjustments due to each of those factors can be derived. The percentage of final census estimates due to adjustments for undercoverage, nonresponse, and misclassification as well as the total percent adjustment for selected items are displayed in Tables A and C.

MEASURED ERRORS IN THE CENSUS PROCESS

NASS uses statistical procedures in compiling the CML, in its data collection procedures, in data editing and processing, and in compiling the final data. Additionally, it uses statistical procedures to both measure errors in the various processes when adjusting for those errors in the final data. One example is the statistical process used to account for undercoverage, nonresponse of farms on the CML, and misclassification of responses to the census. The basis of the undercoverage adjustment is the capture-recapture procedure that uses the area sample enumeration from the JAS. The largest contributors to error in the census estimates are due to the adjustments for nonresponse, undercoverage, misclassification, and integer calibration.

Variability in Census Estimates due to Statistical Adjustment

In conducting the 2022 Census of Agriculture, efforts were initiated to measure error associated with the adjustments for farm operations that were not on the CML; for farm operations that were on the CML but did not respond to the census report form; for farms and nonfarms that were misclassified as nonfarms and farms, respectively; and for integer calibration. These error measurements were developed from the standard error of the estimates at the national, State, and county levels and were expressed as coefficients of variation (CVs) at the national and State levels and as generalized coefficients of variation (GCVs) at the county levels.

The standard error of an estimate is an estimate of the

standard deviation of the sampling distribution of the estimator. In each case, standard errors were computed using an approach based on a delete-a-group jackknife methodology. To conduct the jackknifing, $k = 10$ mutually exclusive and exhaustive groups of records were formed. The groups were selected using a stratified random design so that each group reflected capture status by the CML and the JAS. Based on estimated weights for records in each group, a delete-a-group jackknife estimator of the variance would account for the uncertainty associated with modeling the capture-recapture probabilities and the uncertainty due to integer calibration. Therefore, the weights within each jackknife group were computed using the group-specific models and calibrated to match group-specific targets. For a given data item *i*, such as the number of farms, the estimate was computed at the specified geographical level, such as nation, State, or county, using the weights obtained for group *j*. Estimates of the variance and standard error associated with the estimator T_i are then, respectively,

$$\sigma_i^2 = \frac{k-1}{k}\sum_{j=1}^{k}\left(T_i^{(j)} - \sum_{l=1}^{k}\frac{T_i^{(l)}}{k}\right)^2; \quad SE(T_i) = \sqrt{\sigma_i^2}$$

Ten (10) calibration-adjusted jackknife groups were used to provide standard errors for 2022 State and national estimates (i.e., $k=10$). For the estimate of the number of farms with a given set of characteristics, only the CML records with those characteristics were used to obtain the overall estimate as well as the estimates from each calibrated jackknife group.

Note that the calibrated jackknife groups were only constructed once, and different subsets of the records were used to compute estimates and standard errors for the data items.

The CV is a measure of the relative amount of error associated with the sample estimate:

$$\mathrm{CV}_i = \frac{SE(T_i)}{T_i}100\%$$

where $SE(T_i)$ is the standard error of the capture-recapture estimate for data item *i*. This relative measure allows the reliability of a range of estimates to be compared. For example, the standard error is often larger for large population estimates than for small population estimates, but the large population estimates may have a smaller CV, indicating a more reliable estimate. For county-level estimates, a generalized coefficient of variation (GCV) was determined for each estimate within a State. A generalized variance function relates a function of the variance of an estimator to a function of the estimator. Within a State, the standard error of an estimate for a data item was often found to be linearly related to the estimate of that item with an intercept of zero. Based on this modeled relationship, the GCV is the slope of the line relating the standard error to the estimate, multiplied times 100 to represent the GCV as a percentage.

The standard error is the product of the CV (or GCV for county estimates) and the estimate divided by 100. As an example, if the GCV for a State is 25 percent and a county's estimate is 4, then the standard error is 25(4)/100 = 1. The standard error of an estimated data item from the census provides a measure of the uncertainty associated with that estimated data item due to the possible outcomes of the census collection, including incompleteness of the CML, nonresponse to the census, misclassification either as a farm or as a nonfarm, and the integer calibration. With 95 percent confidence, an estimate is within two standard errors of the true value being estimated. For this example, with 95 percent confidence, the estimate of 4 is within 2(1) = 2 of the true county value.

Note: The standard errors and consequently, the CVs tend to be substantially smaller than those reported for the 2017 Census of Agriculture. For 2017, the model of the probability of capture incorporated information from the approximately 40,000 respondents to the 2017 JAS and the census records matching a JAS record. In contrast, the models for the 2022 Census of Agriculture relied on information from the approximately 1 million responding CML records and the 2022 JAS, some of which were on both the CML and the JAS. The large increase in the number of records used in the modeling process led to a major decrease in the measures of uncertainty (standard errors and CVs).

Table B presents the fully adjusted estimates with the coefficient of variation for selected items.

NONMEASURED ERRORS IN THE CENSUS PROCESS

As noted in the previous section, errors can be introduced from adjustments for coverage, nonresponse, and misclassification and from integer calibration. These errors are measurable. However, nonsampling errors are imbedded in the census process that cannot be directly measured as part of the design of the census but must be contained to ensure an accurate count. Extensive efforts were made to compile a complete and accurate mail list for the census, to elicit response to the census, to design an understandable report form with clear instructions, to minimize processing errors through the use of quality control measures, to reduce matching error associated with the capture-recapture estimation process, and to minimize

error associated with identification of a respondent as a farm operation (referred to as classification error). The weight adjustment and tabulation processes recognize the presence of nonsampling errors; however, it is assumed that these errors are small and that, in total, the net effect is zero. In other words, the positive errors cancel the negative errors.

Respondent and Enumerator Error

Incorrect or incomplete responses to the census report form or to the questions posed by an enumerator can introduce error into the census data. Steps were taken in the design and execution of the Census of Agriculture to reduce errors from respondent reporting. Poor instructions and ambiguous definitions lead to misreporting. Respondents may not remember accurately, may estimate responses, or may record an item in the wrong cell. To reduce reporting and recording errors, the report form was tested prior to the census using industry-accepted cognitive testing procedures. Detailed instructions for completing the report form were provided to each respondent. Questions were phrased as clearly as possible based on previous tests of the report form. Computer-assisted telephone interviewing software included immediate integrity checks of recorded responses so suspect data could be verified or corrected. In addition, each respondent's answers were checked for completeness and consistency by the complex edit and imputation system.

Processing Error

Processing of each census report form was another potential source of nonsampling error. All mail returns that included multiple reports, respondent remarks, or that were marked out of business and report forms with no reported data were sent to an analyst for verification and appropriate action. Integrity checks were performed by the imaging system and data transfer functions. Standard quality control procedures were in place that required that randomly selected batches of data keyed from image be re-entered by a different operator to verify the work and evaluate key entry operators. All systems and programs were thoroughly tested before going on-line and were monitored throughout the processing period.

Developing accurate processing methods is complicated by the complex structure of agriculture. Among the complexities are the many places to be included, the variety of arrangements under which farms are operated, the continuing changes in the relationship of producers to the farm operated, the expiration of leases and the initiation or renewal of leases, the problem of obtaining a complete list of agriculture operations, the difficulty of contacting and identifying some types of contractor/contractee relationships, the producer's absence from the farm during the data collection period, and the producer's opinion that part or all of the operation does not qualify and should not be included in the census. During data collection and processing of the census, all operations underwent a number of quality control checks to ensure results were as accurate as possible.

Item Nonresponse

All item nonresponse actions provide another opportunity to introduce measurement errors. Regardless of whether previously reported data, administrative data, the nearest neighbor algorithm, the fully conditional specification method, or manual imputation is used to complete a nonresponse item, some risk exists that the imputed value does not equal the actual value. Previously reported and administrative data were used only when they related to the census reference period. A new nearest neighbor was randomly selected for each incident to eliminate the chance of a consistent bias.

Record Matching Error

The process of building and expanding the CML involves finding new list sources and checking for names not on the list. An automated processing system compared each new name to the existing CML names and "linked" like records for the purpose of preventing duplication. New names with strong links to a CML name were discarded and those with no links were added as potential farms. Names with weak links, possible matches, were reviewed by staff to determine whether the new name should be added. Despite this thorough review, some new names may have been erroneously added or deleted. Additions could contribute to duplication (overcoverage) whereas deletions could contribute to undercoverage. As a result, some names received more than one report form, and some farm producers did not receive a report form. Respondents were instructed to complete one form and return all forms so the duplication could be removed.

Another chance for error came when comparing June Area Survey tract producer names to the CML. Area producers whose names were not found on the CML were part of the measure of list incompleteness, or NML. Mistakes in determining overlap status resulted in overcounts (including a tract whose producer was on the CML) or undercounts (excluding a tract whose producer was not on the CML). All tracts determined to not be on the list were triple checked to eliminate, or at least minimize, any error. NML tract producers were mailed a report form printed in a different color. To identify duplication, all respondents who received multiple report forms were instructed to complete the CML version and return all forms so

duplication could be removed.

Records in the 2022 JAS were matched to the 2022 census using probabilistic record linkage. The records of operations with differing farm status were sent out to be reviewed by NASS regional field offices. If farm status could not be resolved, the probability of an operation being a farm was imputed using a missing data model. The uncertainty associated with this estimate apart from model uncertainty was accounted for, but errors not found through this process were not.

Table A. **Summary of State Coverage, Nonresponse, and Misclassification Adjustments: 2022**

[For meaning of abbreviations and symbols, see introductory text.]

Item	Total	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
Farms ..... number	63,105	4,120	42.2	14.8	15.6	11.8
Land in farms ..... acres	10,732,951	462,250	34.5	5.6	11.8	17.1
Farms by size:						
1 to 9 acres ..... farms	4,509	962	52.4	20.1	19.4	12.8
acres	23,312	4,491	52.0	21.2	19.2	11.7
10 to 49 acres ..... farms	24,298	1,884	47.6	20.1	16.8	10.7
acres	641,369	43,366	46.5	19.3	16.4	10.8
50 to 69 acres ..... farms	6,520	373	40.9	14.5	15.7	10.7
acres	379,171	21,365	40.8	14.3	15.9	10.6
70 to 99 acres ..... farms	6,132	399	36.2	11.9	14.4	9.9
acres	507,043	32,722	36.2	11.8	14.5	10.0
100 to 139 acres ..... farms	5,636	520	33.4	9.5	12.5	11.4
acres	653,317	60,810	33.3	9.5	12.4	11.4
140 to 179 acres ..... farms	3,478	234	33.0	7.7	13.8	11.5
acres	546,471	36,860	32.9	7.7	13.6	11.6
180 to 219 acres ..... farms	2,380	164	35.2	7.6	14.4	13.1
acres	469,610	32,612	35.2	7.7	14.2	13.3
220 to 259 acres ..... farms	1,630	158	33.0	5.6	12.9	14.5
acres	389,155	37,735	33.1	5.5	12.9	14.7
260 to 499 acres ..... farms	4,552	513	39.9	7.2	12.9	19.9
acres	1,586,599	182,423	40.0	7.0	12.7	20.3
500 to 999 acres ..... farms	2,280	147	45.3	6.0	21.8	17.5
acres	1,524,619	99,754	44.9	5.9	21.7	17.3
1,000 to 1,999 acres ..... farms	966	128	44.1	3.4	19.4	21.3
acres	1,288,979	185,227	43.8	3.2	19.9	20.6
2,000 acres or more ..... farms	724	98	20.7	0.4	4.2	16.1
acres	2,723,306	280,585	17.7	0.4	4.1	13.2
Irrigated land use:						
Harvested cropland ..... farms	2,552	575	31.4	6.6	14.7	10.1
acres	205,038	12,266	15.0	1.7	5.1	8.1
Pastureland and other land ..... farms	213	34	49.8	12.7	24.5	12.6
acres	1,868	120	41.6	11.5	20.7	9.4
Market value of agricultural products sold $1,000	5,161,034	182	20.9	5.0	6.0	9.9
Farms by value of sales:						
Less than $1,000 ..... farms	17,768	2,132	62.5	19.2	22.4	20.8
$1,000	2,798	(Z)	62.8	33.5	17.5	11.8
$1,000 to $2,499 ..... farms	8,345	1,870	46.1	20.6	16.5	9.0
$1,000	13,699	3	46.2	20.5	16.7	9.0
$2,500 to $4,999 ..... farms	7,589	907	39.7	17.8	14.1	7.8
$1,000	27,088	3	39.4	17.6	14.1	7.7
$5,000 to $9,999 ..... farms	8,594	1,182	37.4	16.5	13.0	7.9
$1,000	61,390	9	37.2	16.4	13.0	7.9
$10,000 to $19,999 ..... farms	6,937	356	20.4	6.2	8.0	6.3
$1,000	98,516	5	20.7	6.2	8.2	6.3
$20,000 to $24,999 ..... farms	2,099	160	25.9	6.5	10.3	9.1
$1,000	46,478	4	25.8	6.5	10.3	8.9
$25,000 to $39,999 ..... farms	3,563	262	29.4	8.0	12.4	9.0
$1,000	111,692	9	29.6	8.1	12.4	9.1
$40,000 to $49,999 ..... farms	1,443	264	38.7	9.7	16.3	12.7
$1,000	64,018	12	38.7	9.7	16.3	12.7
$50,000 to $99,999 ..... farms	2,448	145	24.5	4.0	11.9	8.6
$1,000	170,794	11	25.1	4.1	11.9	9.1
$100,000 to $249,999 ..... farms	1,574	100	26.2	5.2	10.3	10.7
$1,000	241,963	12	26.6	5.0	10.4	11.2
$250,000 to $499,999 ..... farms	849	71	43.0	3.9	26.7	12.4
$1,000	294,333	30	42.1	3.7	26.3	12.1
$500,000 to $999,999 ..... farms	719	71	39.6	3.3	16.9	19.5
$1,000	520,334	59	40.1	3.3	16.8	20.1
$1,000,000 or more ..... farms	1,177	65	18.7	3.3	4.6	10.8
$1,000	3,507,931	148	14.5	4.3	2.2	8.0
Farms by legal status for tax purposes:						
Family or individual ..... farms	58,952	3,898	42.2	15.6	14.8	11.9
acres	8,428,649	388,161	36.9	6.5	11.9	18.6
Partnership ..... farms	2,477	159	40.5	10.1	22.3	8.1
acres	1,619,361	44,803	20.2	2.5	7.0	10.7
Corporation:						
Family held ..... farms	863	80	41.6	6.7	21.2	13.7
acres	352,535	21,083	27.0	3.2	10.8	13.0
Other than family held ..... farms	227	20	50.2	4.9	25.4	19.8
acres	108,679	51,204	55.7	1.4	39.6	14.7
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	586	51	45.7	9.0	25.6	11.1
acres	223,727	36,460	48.9	7.4	16.5	25.1
Tenure:						
Full owners ..... farms	48,340	3,290	44.4	16.9	16.0	11.5
acres	4,760,167	245,880	41.1	7.8	13.4	19.9
Part owners ..... farms	12,976	867	34.2	5.1	14.4	14.7
acres	5,597,337	270,793	29.0	2.1	11.3	15.6
Tenants ..... farms	1,789	156	41.1	8.0	17.8	15.3
acres	375,447	36,027	34.5	7.9	12.8	13.7
Producers characteristics by- [1] (see text)						
Sex of operator:						
Male ..... farms	58,559	4,014	41.9	13.8	16.3	11.8
acres	10,316,569	458,752	34.4	5.1	12.0	17.2
Female ..... farms	35,500	3,006	43.0	18.6	19.3	5.0
acres	4,587,675	234,515	34.8	11.5	18.1	5.2
Primary occupation:						
Farming ..... farms	40,388	2,966	38.8	13.8	17.4	7.6
Other ..... farms	67,429	4,957	46.7	13.7	23.2	9.7

See footnote(s) at end of table.

--continued

Table A. **Summary of State Coverage, Nonresponse, and Misclassification Adjustments: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Item		Total	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
Producers characteristics by- [1] (see text) - Con.							
Hispanic, Latino, or Spanish origin	farms	1,006	82	48.9	13.6	23.2	12.1
	acres	122,635	14,798	38.6	7.8	19.6	11.2
Race:							
American Indian or Alaska Native	farms	290	98	40.3	15.9	15.6	8.8
	acres	36,580	4,363	18.0	5.5	9.0	3.4
Asian	farms	191	27	40.3	8.6	21.5	10.2
	acres	17,969	1,997	23.4	5.7	11.0	6.7
Black or African American	farms	815	129	46.5	16.2	18.6	11.7
	acres	95,387	16,708	42.1	10.3	16.3	15.5
Native Hawaiian or Other Pacific Islander	farms	47	6	48.9	16.8	29.5	2.6
	acres	16,824	7,682	32.6	18.6	10.1	3.9
White	farms	61,929	4,166	42.2	14.8	15.6	11.7
	acres	10,586,544	453,471	34.5	5.6	11.8	17.1
More than one race reported	farms	687	184	47.0	18.9	18.3	9.8
	acres	78,315	16,514	30.8	11.5	12.2	7.1
Military service:							
Never served or only on active duty for training in the Reserves or National Guard (see text)	producers	95,685	7,081	43.8	13.4	21.6	8.9
Active duty now or in the past (see text)	producers	12,132	828	43.0	15.4	17.5	10.0
All producers by age group [1]:							
Under 25 years	farms	1,762	279	53.9	14.0	35.2	4.7
25 to 34 years	farms	6,262	769	58.6	8.7	37.8	12.1
35 to 44 years	farms	12,022	1,355	51.2	13.0	27.1	11.1
45 to 54 years	farms	17,390	1,666	44.2	11.2	19.9	13.1
55 to 64 years	farms	28,182	1,942	44.4	12.6	23.1	8.7
65 to 74 years	farms	26,354	1,591	39.1	18.0	14.3	6.8
75 years and over	farms	15,845	865	37.1	18.3	14.1	4.7
Net cash farm income of operations:							
Farms with gains of- [2]							
Less than $1,000	farms	2,431	214	41.6	16.6	13.7	11.3
	$1,000	1,154	(Z)	40.4	15.9	13.7	10.8
$1,000 to $4,999	farms	5,585	473	34.7	13.2	12.5	8.9
	$1,000	14,922	1	33.4	12.9	11.7	8.7
$5,000 to $9,999	farms	3,226	278	27.2	9.8	8.7	8.6
	$1,000	23,364	2	27.1	9.6	8.8	8.7
$10,000 to $24,999	farms	3,867	197	26.7	7.0	10.2	9.5
	$1,000	62,074	3	26.8	7.0	10.2	9.6
$25,000 to $49,999	farms	2,041	120	26.6	5.2	12.2	9.2
	$1,000	72,209	4	26.3	5.2	11.8	9.3
$50,000 or more	farms	3,822	191	27.8	4.3	10.6	12.9
	$1,000	1,525,628	52	19.4	4.6	5.1	9.7
Farms with losses of-							
Less than $1,000	farms	3,260	305	45.2	20.2	14.5	10.5
	$1,000	1,598	(Z)	44.9	20.3	15.2	9.5
$1,000 to $4,999	farms	13,360	884	49.0	19.3	17.0	12.8
	$1,000	38,345	2	49.0	19.1	17.6	12.3
$5,000 to $9,999	farms	9,799	578	48.2	18.3	18.5	11.4
	$1,000	70,530	4	48.1	18.5	18.4	11.2
$10,000 to $24,999	farms	10,349	911	48.0	17.3	17.7	13.1
	$1,000	161,028	15	47.8	16.9	18.2	12.7
$25,000 to $49,999	farms	3,381	315	46.4	11.8	20.3	14.3
	$1,000	116,145	11	46.4	11.8	20.3	14.3
$50,000 or more	farms	1,984	239	44.7	8.1	20.6	16.0
	$1,000	234,923	17	44.1	5.8	22.1	16.1
Livestock and poultry:							
Cattle and calves inventory	farms	29,742	1,623	35.7	19.7	6.2	9.8
	number	1,636,047	37,632	40.8	14.5	8.4	17.8
Beef cows inventory	farms	27,341	1,577	35.5	19.4	6.3	9.9
	number	857,327	36,114	41.4	16.4	9.2	15.8
Milk cows inventory	farms	680	26	20.6	11.9	3.6	5.1
	number	24,525	1,188	7.3	1.7	0.8	4.8
Hog and pigs inventory	farms	1,643	369	46.5	13.2	17.7	15.6
	number	281,105	66,687	20.7	3.4	1.8	15.5
Layers inventory	farms	8,886	1,527	44.6	15.9	17.4	11.3
	number	2,520,707	268,062	27.8	5.4	10.6	11.8
Broilers sold	farms	664	135	36.7	9.6	16.9	10.2
	number	189,393,169	14,906,992	22.4	8.6	2.9	10.8
Aquaculture sold	farms	60	12	26.7	6.7	6.8	13.2
	$1,000	8,822	1	4.5	2.3	(Z)	2.3
Selected crops harvested:							
Corn for grain	farms	3,596	270	32.8	9.4	13.2	10.2
	acres	807,824	58,141	18.1	1.7	5.9	10.5
Durum wheat for grain	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Other spring wheat for grain	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Winter wheat for grain	farms	1,233	76	27.3	3.7	13.3	10.3
	acres	345,786	20,013	16.3	1.0	5.3	10.0
Sorghum for grain	farms	22	6	27.3	0.8	9.3	17.2
	acres	4,230	1,362	27.3	0.2	8.2	18.9
Soybeans for beans	farms	3,762	357	27.6	3.5	13.5	10.7
	acres	1,571,542	99,293	20.9	0.8	7.5	12.6
Rice	farms	3	1	(Z)	(Z)	(Z)	(Z)
	acres	(D)	(D)	(D)	(D)	(D)	(D)
Cotton	farms	532	88	24.2	6.1	10.5	7.7
	acres	331,791	23,593	12.2	1.6	4.5	6.1

See footnote(s) at end of table.

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Table A. **Summary of State Coverage, Nonresponse, and Misclassification Adjustments: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Item		Total	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
Selected crops harvested: - Con.							
Peanuts	farms	8	4	37.5	32.6	4.9	(Z)
	acres	11	7	45.5	40.7	4.8	(Z)
Barley	farms	17	5	23.5	5.4	17.3	0.9
	acres	841	208	13.2	1.2	10.7	1.3
Oats	farms	44	5	27.3	18.1	5.0	4.2
	acres	1,121	220	18.2	8.2	4.1	5.9
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	33,430	2,025	37.2	19.6	12.2	5.4
	acres	1,534,154	62,308	35.9	14.6	13.5	7.8
Land in vegetables (see text)	farms	1,770	1,312	18.0	5.2	11.5	1.3
	acres	19,571	2,979	2.9	0.7	1.8	0.4
Potatoes	farms	505	333	21.0	6.5	11.7	2.7
	acres	354	170	18.3	3.4	4.7	10.1
Tomatoes in the open	farms	895	684	14.5	4.2	9.9	0.5
	acres	3,699	430	1.4	0.7	0.5	0.3
Sweet corn (see text)	farms	605	460	15.9	3.8	11.5	0.5
	acres	1,491	451	5.7	0.7	4.8	0.2
Lettuce	farms	240	183	11.3	2.5	8.5	0.3
	acres	76	38	10.2	1.5	8.5	0.2
Land in orchards (see text)	farms	1,580	285	43.6	8.2	19.7	15.7
	acres	4,952	470	32.2	5.2	12.9	14.2
Apples	farms	825	127	44.2	7.5	20.1	16.7
	acres	1,415	88	30.4	4.9	11.0	14.5
Grapes (including muscadine) (see text)	farms	472	121	39.6	8.2	20.6	10.9
	acres	789	180	30.9	6.5	18.1	6.2
Oranges	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Almonds	farms	9	2	33.3	11.7	16.4	5.2
	acres	2	1	36.4	16.4	17.1	2.9
Land in berries	farms	1,144	267	37.5	7.7	18.8	11.0
	acres	1,340	206	26.6	5.6	12.0	9.0

[1] Data were collected for a maximum of four producers per farm.
[2] Farms with total production expenses equal to market value of agricultural products sold, government payments, and farm-related income are included as farms with gains of less than $1,000.

Table B. **Reliability Estimates of State Totals: 2022**

[For meaning of abbreviations and symbols, see introductory text.]

Item	Total	Coefficient of variation (percent)
Farms ..... number	63,105	6.5
Land in farms ..... acres	10,732,951	4.3
Farms by size:		
1 to 9 acres ..... farms	4,509	21.3
acres	23,312	19.3
10 to 49 acres ..... farms	24,298	7.8
acres	641,369	6.8
50 to 69 acres ..... farms	6,520	5.7
acres	379,171	5.6
70 to 99 acres ..... farms	6,132	6.5
acres	507,043	6.5
100 to 139 acres ..... farms	5,636	9.2
acres	653,317	9.3
140 to 179 acres ..... farms	3,478	6.7
acres	546,471	6.7
180 to 219 acres ..... farms	2,380	6.9
acres	469,610	6.9
220 to 259 acres ..... farms	1,630	9.7
acres	389,155	9.7
260 to 499 acres ..... farms	4,552	11.3
acres	1,586,599	11.5
500 to 999 acres ..... farms	2,280	6.4
acres	1,524,619	6.5
1,000 to 1,999 acres ..... farms	966	13.2
acres	1,288,979	14.4
2,000 acres or more ..... farms	724	13.5
acres	2,723,306	10.3
Irrigated land use:		
Harvested cropland ..... farms	2,552	22.5
acres	205,038	6.0
Pastureland and other land ..... farms	213	16.1
acres	1,868	6.4
Market value of agricultural products sold $1,000	5,161,034	3.5
Farms by value of sales:		
Less than $1,000 ..... farms	17,768	12.0
$1,000	2,798	13.5
$1,000 to $2,499 ..... farms	8,345	22.4
$1,000	13,699	21.4
$2,500 to $4,999 ..... farms	7,589	12.0
$1,000	27,088	12.2
$5,000 to $9,999 ..... farms	8,594	13.8
$1,000	61,390	14.4
$10,000 to $19,999 ..... farms	6,937	5.1
$1,000	98,516	5.2
$20,000 to $24,999 ..... farms	2,099	7.6
$1,000	46,478	7.8
$25,000 to $39,999 ..... farms	3,563	7.4
$1,000	111,692	7.6
$40,000 to $49,999 ..... farms	1,443	18.3
$1,000	64,018	18.2
$50,000 to $99,999 ..... farms	2,448	5.9
$1,000	170,794	6.4
$100,000 to $249,999 ..... farms	1,574	6.3
$1,000	241,963	5.1
$250,000 to $499,999 ..... farms	849	8.4
$1,000	294,333	10.1
$500,000 to $999,999 ..... farms	719	9.8
$1,000	520,334	11.4
$1,000,000 or more ..... farms	1,177	5.5
$1,000	3,507,931	4.2
Farms by legal status for tax purposes:		
Family or individual ..... farms	58,952	6.6
acres	8,428,649	4.6
Partnership ..... farms	2,477	6.4
acres	1,619,361	2.8
Corporation:		
Family held ..... farms	863	9.3
acres	352,535	6.0
Other than family held ..... farms	227	9.0
acres	108,679	47.1
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	586	8.7
acres	223,727	16.3
Tenure:		
Full owners ..... farms	48,340	6.8
acres	4,760,167	5.2
Part owners ..... farms	12,976	6.7
acres	5,597,337	4.8
Tenants ..... farms	1,789	8.7
acres	375,447	9.6
Producers characteristics by- [1] (see text)		
Sex of operator:		
Male ..... farms	58,559	6.9
acres	10,316,569	4.4
Female ..... farms	35,500	8.5
acres	4,587,675	5.1
Primary occupation:		
Farming ..... farms	40,388	7.3
Other ..... farms	67,429	7.4

Item	Total	Coefficient of variation (percent)
Producers characteristics by- [1] (see text) - Con.		
Hispanic, Latino, or Spanish origin ..... farms	1,006	8.2
acres	122,635	12.1
Race:		
American Indian or Alaska Native ..... farms	290	33.7
acres	36,580	11.9
Asian ..... farms	191	14.3
acres	17,969	11.1
Black or African American ..... farms	815	15.8
acres	95,387	17.5
Native Hawaiian or Other Pacific Islander ..... farms	47	13.2
acres	16,824	45.7
White ..... farms	61,929	6.7
acres	10,586,544	4.3
More than one race reported ..... farms	687	26.8
acres	78,315	21.1
Military service:		
Never served or only on active duty for training in the Reserves or National Guard (see text) ..... producers	95,685	7.4
Active duty now or in the past (see text) ..... producers	12,132	6.8
All producers by age group [1]:		
Under 25 years ..... farms	1,762	15.8
25 to 34 years ..... farms	6,262	12.3
35 to 44 years ..... farms	12,022	11.3
45 to 54 years ..... farms	17,390	9.6
55 to 64 years ..... farms	28,182	6.9
65 to 74 years ..... farms	26,354	6.0
75 years and over ..... farms	15,845	5.5
Net cash farm income of operations:		
Farms with gains of- [2]		
Less than $1,000 ..... farms	2,431	8.8
$1,000	1,154	10.1
$1,000 to $4,999 ..... farms	5,585	8.5
$1,000	14,922	8.7
$5,000 to $9,999 ..... farms	3,226	8.6
$1,000	23,364	8.3
$10,000 to $24,999 ..... farms	3,867	5.1
$1,000	62,074	5.3
$25,000 to $49,999 ..... farms	2,041	5.9
$1,000	72,209	5.8
$50,000 or more ..... farms	3,822	5.0
$1,000	1,525,628	3.4
Farms with losses of-		
Less than $1,000 ..... farms	3,260	9.4
$1,000	1,598	9.7
$1,000 to $4,999 ..... farms	13,360	6.6
$1,000	38,345	6.1
$5,000 to $9,999 ..... farms	9,799	5.9
$1,000	70,530	5.9
$10,000 to $24,999 ..... farms	10,349	8.8
$1,000	161,028	9.4
$25,000 to $49,999 ..... farms	3,381	9.3
$1,000	116,145	9.9
$50,000 or more ..... farms	1,984	12.1
$1,000	234,923	7.4
Livestock and poultry:		
Cattle and calves inventory ..... farms	29,742	5.5
number	1,636,047	2.3
Beef cows inventory ..... farms	27,341	5.8
number	857,327	4.2
Milk cows inventory ..... farms	680	3.9
number	24,525	4.8
Hog and pigs inventory ..... farms	1,643	22.4
number	281,105	23.7
Layers inventory ..... farms	8,886	17.2
number	2,520,707	10.6
Broilers sold ..... farms	664	20.4
number	189,393,169	7.9
Aquaculture sold ..... farms	60	20.4
$1,000	8,822	10.6
Selected crops harvested:		
Corn for grain ..... farms	3,596	7.5
acres	807,824	7.2
Durum wheat for grain ..... farms	-	-
acres	-	-
Other spring wheat for grain ..... farms	-	-
acres	-	-
Winter wheat for grain ..... farms	1,233	6.2
acres	345,786	5.8
Sorghum for grain ..... farms	22	27.6
acres	4,230	32.2
Soybeans for beans ..... farms	3,762	9.5
acres	1,571,542	6.3
Rice ..... farms	3	44.7
acres	(D)	(D)

See footnote(s) at end of table.

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Table B. **Reliability Estimates of State Totals: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Item		Total	Coefficient of variation (percent)
Selected crops harvested: - Con.			
Cotton	farms	532	16.5
	acres	331,791	7.1
Peanuts	farms	8	48.9
	acres	11	65.7
Barley	farms	17	26.8
	acres	841	24.7
Oats	farms	44	12.4
	acres	1,121	19.7
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	33,430	6.1
	acres	1,534,154	4.1
Land in vegetables (see text)	farms	1,770	74.2
	acres	19,571	15.2
Potatoes	farms	505	65.9
	acres	354	47.9
Tomatoes in the open	farms	895	76.4
	acres	3,699	11.6
Selected crops harvested: - Con. Land in vegetables (see text) - Con.			
Sweet corn (see text)	farms	605	76.0
	acres	1,491	30.3
Lettuce	farms	240	76.2
	acres	76	50.1
Land in orchards (see text)	farms	1,580	18.0
	acres	4,952	9.5
Apples	farms	825	15.4
	acres	1,415	6.2
Grapes (including muscadine) (see text)	farms	472	25.7
	acres	789	22.9
Oranges	farms	-	-
	acres	-	-
Almonds	farms	9	25.8
	acres	2	35.6
Land in berries	farms	1,144	23.4
	acres	1,340	15.3

[1] Data were collected for a maximum of four producers per farm.
[2] Farms with total production expenses equal to market value of agricultural products sold, government payments, and farm-related income are included as farms with gains of less than $1,000.

Table C. **Summary of Coverage, Nonresponse, and Misclassification Adjustments by County: 2022**

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
ALL FARMS (NUMBER)						
State Total						
Tennessee	63,105	4,120	42.4	14.8	15.7	11.9
Counties						
Anderson	462	57	41.7	11.9	23.9	5.9
Bedford	1,357	101	45.2	17.1	15.6	12.5
Benton	401	47	44.1	10.9	17.2	16.0
Bledsoe	479	65	39.6	15.9	10.5	13.3
Blount	925	66	39.7	15.4	15.4	8.9
Bradley	677	39	39.3	18.9	11.8	8.5
Campbell	309	49	41.8	17.8	11.0	13.1
Cannon	582	51	47.1	19.2	21.9	6.0
Carroll	760	108	40.5	11.0	13.8	15.7
Carter	396	37	43.5	22.2	15.8	5.5
Cheatham	434	53	39.8	15.4	13.8	10.6
Chester	351	51	42.0	14.4	15.2	12.3
Claiborne	865	69	39.6	18.6	10.8	10.2
Clay	364	52	45.7	16.0	22.2	7.5
Cocke	606	53	40.2	17.4	11.1	11.8
Coffee	731	63	39.0	13.2	14.3	11.6
Crockett	336	32	41.1	10.1	17.8	13.2
Cumberland	818	73	41.7	15.5	14.6	11.6
Davidson	350	48	43.6	11.0	18.4	14.2
Decatur	348	23	38.4	5.5	10.5	22.5
DeKalb	579	44	43.8	16.1	14.6	13.1
Dickson	1,060	93	45.7	17.9	16.8	10.9
Dyer	407	55	44.6	11.0	21.3	12.3
Fayette	783	70	48.1	14.8	16.9	16.5
Fentress	536	32	42.1	14.2	13.2	14.8
Franklin	686	88	37.2	16.2	11.9	9.1
Gibson	769	87	39.4	11.4	15.6	12.4
Giles	1,457	159	42.2	9.5	21.1	11.6
Grainger	814	62	40.1	14.8	18.8	6.5
Greene	2,344	109	38.6	19.1	10.8	8.7
Grundy	201	57	43.4	18.6	11.6	13.2
Hamblen	451	36	40.2	19.5	14.2	6.5
Hamilton	489	56	46.7	16.2	20.3	10.2
Hancock	351	33	40.2	17.9	10.6	11.7
Hardeman	598	63	44.4	7.2	15.6	21.6
Hardin	448	44	40.7	14.4	11.6	14.7
Hawkins	1,283	125	38.4	15.3	13.7	9.4
Haywood	365	55	37.0	9.5	11.1	16.5
Henderson	656	75	40.7	13.4	13.8	13.5
Henry	808	83	39.7	11.4	14.8	13.6
Hickman	651	45	42.2	14.9	16.4	10.9
Houston	280	32	37.1	16.6	11.5	9.0
Humphreys	595	66	43.6	12.2	15.6	15.9
Jackson	523	27	42.3	18.7	12.2	11.4
Jefferson	826	35	40.0	21.1	12.3	6.6
Johnson	436	36	41.0	21.4	14.4	5.2
Knox	862	90	47.2	15.8	22.0	9.5
Lake	48	15	43.3	7.3	19.7	16.3
Lauderdale	427	75	43.8	10.0	14.7	19.1
Lawrence	1,227	106	41.9	13.8	16.3	11.8
Lewis	253	52	47.7	11.2	15.9	20.5
Lincoln	1,450	117	43.9	17.9	15.2	10.8
Loudon	640	58	45.1	18.3	16.6	10.2
McMinn	975	99	43.1	17.4	13.6	12.1
McNairy	590	43	45.5	15.9	17.3	12.3
Macon	788	65	38.3	17.2	9.8	11.4
Madison	618	108	43.1	9.9	14.2	19.0
Marion	308	31	47.2	7.5	25.6	14.1
Marshall	995	58	43.5	18.5	12.8	12.1
Maury	1,442	60	46.3	17.5	18.2	10.6
Meigs	315	32	43.3	14.1	12.5	16.6
Monroe	740	111	42.2	16.7	16.7	8.7
Montgomery	764	43	44.6	15.2	20.4	9.0
Moore	281	41	41.9	17.2	11.2	13.5
Morgan	425	43	44.4	16.5	20.2	7.7
Obion	538	45	39.0	11.6	10.7	16.7
Overton	922	69	43.2	15.9	14.5	12.9
Perry	251	25	49.0	13.3	14.8	20.9
Pickett	240	23	37.7	17.6	12.7	7.4
Polk	269	31	39.1	19.3	11.4	8.5
Putnam	883	69	43.8	18.5	15.0	10.4
Rhea	477	33	44.8	18.7	16.1	9.9
Roane	582	42	44.4	16.9	17.4	10.1
Robertson	1,117	78	40.7	15.2	13.1	12.5
Rutherford	1,270	98	45.3	15.0	24.0	6.2
Scott	255	18	37.4	15.2	8.8	13.5
Sequatchie	183	11	33.7	12.3	7.8	13.7
Sevier	503	47	41.0	14.4	15.3	11.2
Shelby	417	45	51.0	14.2	18.3	18.5
Smith	758	47	42.2	15.8	17.2	9.2
Stewart	360	53	47.8	12.4	20.9	14.5
Sullivan	1,050	86	42.7	20.3	15.3	7.1
Sumner	1,248	46	43.5	18.2	13.8	11.6

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Table C. **Summary of Coverage, Nonresponse, and Misclassification Adjustments by County: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
ALL FARMS (NUMBER) - Con.						
Counties - Con.						
Tipton	456	57	42.3	15.3	16.4	10.5
Trousdale	293	16	39.3	16.2	15.4	7.7
Unicoi	80	20	45.8	18.7	12.5	14.5
Union	442	37	38.5	16.4	15.0	7.1
Van Buren	269	18	37.6	15.7	14.8	7.1
Warren	985	63	44.3	10.7	17.6	16.0
Washington	1,288	97	40.6	20.5	12.5	7.6
Wayne	627	74	43.2	11.8	19.5	11.9
Weakley	836	145	38.5	8.5	16.4	13.6
White	815	85	38.0	15.4	11.5	11.1
Williamson	1,153	77	45.8	20.1	17.6	8.1
Wilson	1,443	156	44.1	16.2	15.5	12.4
LAND IN FARMS (ACRES)						
State Total						
Tennessee	10,732,951	462,250	35.7	6.1	12.9	16.8
Counties						
Anderson	35,952	3,301	39.7	10.0	23.2	6.5
Bedford	236,001	21,422	45.0	12.5	17.5	15.0
Benton	70,176	12,005	40.3	7.3	17.4	15.6
Bledsoe	86,860	13,720	37.7	8.1	7.9	21.7
Blount	93,875	12,091	38.2	10.9	14.3	13.0
Bradley	79,716	5,865	36.2	12.8	9.0	14.3
Campbell	30,815	8,608	43.1	17.3	10.0	15.8
Cannon	90,171	9,829	44.5	13.5	23.1	7.9
Carroll	179,424	16,031	21.4	3.3	10.5	7.5
Carter	28,788	7,352	46.2	17.9	22.4	5.9
Cheatham	45,289	9,048	32.1	10.6	11.2	10.4
Chester	77,906	9,195	28.0	6.7	11.4	9.9
Claiborne	106,999	19,816	45.9	17.7	15.1	13.1
Clay	61,730	11,227	38.3	12.7	16.2	9.5
Cocke	56,129	4,388	40.2	14.1	11.3	14.8
Coffee	143,516	24,802	40.5	9.4	15.8	15.3
Crockett	149,840	13,267	23.5	2.3	8.2	13.0
Cumberland	130,350	16,935	38.1	13.3	15.9	8.9
Davidson	31,523	3,455	40.7	9.6	18.9	12.2
Decatur	85,476	13,898	38.0	0.4	9.9	27.8
DeKalb	89,080	8,842	41.4	10.6	12.5	18.3
Dickson	124,779	13,146	44.8	15.3	18.5	11.0
Dyer	249,678	41,308	28.1	2.7	10.8	14.6
Fayette	224,887	19,107	21.6	4.1	6.4	11.1
Fentress	109,309	8,805	36.7	12.6	8.2	15.9
Franklin	115,142	14,465	24.4	6.0	7.9	10.5
Gibson	287,725	26,406	29.8	3.7	11.7	14.3
Giles	241,228	20,622	40.4	5.9	14.3	20.2
Grainger	83,178	8,637	36.9	11.9	17.6	7.4
Greene	209,228	12,113	40.7	17.5	11.5	11.6
Grundy	29,669	10,087	41.3	7.6	9.8	24.0
Hamblen	50,177	6,697	36.4	11.5	14.7	10.2
Hamilton	53,018	9,509	42.6	10.2	22.8	9.6
Hancock	55,692	11,928	41.2	16.9	12.5	11.8
Hardeman	159,283	21,913	42.6	5.0	15.1	22.5
Hardin	121,675	17,564	34.1	6.2	7.0	20.9
Hawkins	119,016	15,899	38.5	9.1	17.1	12.3
Haywood	240,650	19,047	23.6	2.1	8.8	12.7
Henderson	126,971	14,482	35.7	7.1	10.1	18.5
Henry	219,320	24,660	31.8	5.3	10.4	16.2
Hickman	140,776	22,894	41.5	8.9	12.6	20.0
Houston	49,243	2,626	38.4	17.4	11.7	9.3
Humphreys	197,896	40,643	43.9	5.5	15.9	22.5
Jackson	77,471	5,208	47.4	17.3	15.0	15.1
Jefferson	82,883	6,419	37.7	16.5	11.2	9.9
Johnson	32,922	4,653	34.2	16.2	13.0	4.9
Knox	53,515	6,165	40.3	11.8	19.4	9.1
Lake	61,488	3,699	12.4	0.2	0.9	11.2
Lauderdale	212,357	46,768	28.5	3.7	10.6	14.3
Lawrence	238,241	22,797	32.7	5.0	11.9	15.8
Lewis	43,444	13,410	55.3	6.7	26.6	22.0
Lincoln	270,934	13,017	36.6	11.6	13.2	11.9
Loudon	55,880	7,219	40.1	16.9	15.5	7.7
McMinn	128,548	10,263	40.4	12.4	14.4	13.7
McNairy	115,586	11,297	35.8	11.0	15.5	9.3
Macon	116,893	3,098	32.1	12.5	9.4	10.3
Madison	166,694	25,974	27.0	2.8	6.6	17.6
Marion	62,071	24,516	41.1	3.1	26.6	11.4
Marshall	144,148	10,299	41.4	15.9	12.7	12.8
Maury	209,805	28,585	45.4	11.9	19.2	14.3
Meigs	50,781	6,521	42.1	7.9	10.5	23.6
Monroe	97,164	6,358	42.5	11.5	23.0	8.0
Montgomery	169,300	35,769	35.3	10.4	15.1	9.8
Moore	63,825	16,727	40.8	8.9	9.3	22.6
Morgan	60,675	3,623	42.8	14.1	20.1	8.6
Obion	245,012	17,027	21.5	1.4	4.0	16.1
Overton	155,629	23,145	35.5	9.9	10.4	15.1

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Table C. **Summary of Coverage, Nonresponse, and Misclassification Adjustments by County: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
LAND IN FARMS (ACRES) - Con.						
Counties - Con.						
Perry	52,642	3,298	44.1	8.0	12.8	23.3
Pickett	34,644	5,912	37.1	13.9	12.5	10.6
Polk	36,004	3,538	27.7	9.3	7.3	11.0
Putnam	93,450	12,002	46.8	13.9	15.7	17.2
Rhea	63,329	12,815	45.4	12.7	20.0	12.7
Roane	49,741	3,415	36.4	7.8	14.6	14.1
Robertson	200,408	15,783	26.5	5.7	6.3	14.5
Rutherford	136,070	13,117	45.7	17.0	20.3	8.4
Scott	31,350	2,892	44.1	9.9	9.5	24.7
Sequatchie	27,745	2,604	37.8	14.7	8.0	15.1
Sevier	42,774	3,102	39.4	15.8	15.8	7.9
Shelby	90,742	19,495	35.3	5.2	19.0	11.1
Smith	126,226	5,677	39.1	10.0	19.4	9.6
Stewart	57,371	5,340	40.2	6.5	15.8	17.9
Sullivan	79,194	5,537	40.5	15.8	14.7	9.9
Sumner	140,142	14,153	35.6	13.8	10.6	11.2
Tipton	191,704	20,353	20.7	2.3	14.4	4.1
Trousdale	39,419	4,044	38.3	13.7	11.1	13.5
Unicoi	3,748	780	31.1	13.1	7.7	10.3
Union	72,210	13,278	46.0	14.6	22.9	8.5
Van Buren	35,288	5,340	30.2	4.5	23.3	2.4
Warren	147,088	13,679	45.3	6.4	20.8	18.1
Washington	97,476	10,775	41.4	18.6	12.3	10.5
Wayne	136,826	56,740	35.6	7.6	17.7	10.3
Weakley	291,965	42,348	29.1	1.7	17.9	9.5
White	107,015	10,421	33.2	9.0	12.4	11.8
Williamson	134,957	7,628	44.7	16.5	19.0	9.3
Wilson	180,001	14,399	39.0	11.8	13.2	14.1
SALES ($1,000)						
State Total						
Tennessee	5,161,034	182	22.4	5.4	6.6	10.3
Counties						
Anderson	4,752	1	34.4	8.8	8.1	17.5
Bedford	149,791	4	20.9	7.0	2.0	11.8
Benton	10,701	1	17.0	4.3	7.3	5.4
Bledsoe	49,077	10	18.2	3.4	2.7	12.2
Blount	26,620	3	32.9	8.2	19.1	5.6
Bradley	149,369	10	17.2	5.8	1.5	10.0
Campbell	3,715	1	31.3	8.9	10.9	11.5
Cannon	23,252	3	41.0	9.5	19.2	12.3
Carroll	96,244	6	11.2	0.9	6.5	3.8
Carter	7,565	1	27.7	10.8	12.9	4.1
Cheatham	10,645	2	33.2	9.0	18.9	5.4
Chester	32,673	4	17.7	3.2	8.7	5.9
Claiborne	16,851	5	33.4	13.9	10.5	9.1
Clay	45,368	5	13.9	5.6	4.4	3.9
Cocke	81,229	5	11.9	5.3	4.5	2.1
Coffee	65,437	14	33.7	6.7	15.0	12.0
Crockett	95,168	8	18.7	1.9	3.6	13.3
Cumberland	36,923	10	19.9	5.2	11.2	3.5
Davidson	15,413	5	13.6	1.5	4.1	8.0
Decatur	16,888	7	37.8	4.5	23.1	10.2
DeKalb	29,880	4	21.2	5.4	3.7	12.2
Dickson	17,035	6	34.6	9.7	8.9	16.0
Dyer	161,827	19	25.3	1.4	6.2	17.7
Fayette	118,353	8	15.1	0.8	2.8	11.5
Fentress	69,202	11	11.4	5.5	2.9	3.1
Franklin	133,454	10	9.9	3.2	3.0	3.7
Gibson	186,243	14	25.5	5.2	8.4	12.0
Giles	76,613	6	29.0	8.7	9.6	10.7
Grainger	32,381	4	24.2	5.3	8.8	10.1
Greene	69,743	5	21.0	8.3	7.8	5.0
Grundy	33,482	3	18.4	7.3	2.7	8.3
Hamblen	24,242	2	13.1	4.5	3.3	5.3
Hamilton	30,460	4	11.7	3.3	3.4	5.0
Hancock	7,180	2	26.0	12.2	8.4	5.4
Hardeman	22,199	4	21.5	1.7	4.4	15.4
Hardin	21,898	6	28.1	1.3	4.8	22.0
Hawkins	24,025	5	23.2	10.3	7.7	5.2
Haywood	153,156	12	22.0	1.4	10.7	9.8
Henderson	28,548	2	32.8	7.5	12.1	13.2
Henry	143,982	21	21.3	3.2	4.9	13.2
Hickman	20,923	6	16.5	4.0	6.3	6.2
Houston	5,951	2	33.2	11.1	11.2	10.9
Humphreys	15,452	5	24.1	1.8	7.2	15.2
Jackson	10,014	1	18.1	7.5	6.2	4.4
Jefferson	23,367	3	26.0	17.1	3.8	5.1
Johnson	4,357	1	25.0	7.5	14.1	3.5
Knox	21,408	5	31.2	7.8	20.2	3.2
Lake	48,331	2	9.6	0.1	0.5	9.0
Lauderdale	131,783	28	23.6	1.9	14.7	7.0
Lawrence	101,055	11	16.0	2.3	5.7	7.9
Lewis	5,459	2	57.6	6.1	45.6	5.9

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Table C. **Summary of Coverage, Nonresponse, and Misclassification Adjustments by County: 2022** (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
SALES ($1,000) - Con.						
Counties - Con.						
Lincoln	196,033	26	31.3	14.4	8.0	8.9
Loudon	94,948	3	5.6	5.2	0.3	0.1
McMinn	88,305	8	33.4	10.4	13.8	9.1
McNairy	25,317	4	23.4	8.5	8.5	6.4
Macon	70,648	6	13.9	7.0	0.9	5.9
Madison	70,451	8	19.5	1.7	9.2	8.5
Marion	43,097	20	26.6	3.9	22.1	0.6
Marshall	85,469	29	54.0	37.3	8.0	8.7
Maury	50,538	5	32.4	7.7	12.3	12.5
Meigs	8,280	2	32.4	8.5	15.8	8.1
Monroe	34,978	4	21.9	7.3	7.7	6.9
Montgomery	87,221	31	38.0	8.3	16.8	13.0
Moore	17,078	8	40.3	9.0	10.3	21.0
Morgan	15,447	2	20.1	6.9	9.8	3.5
Obion	207,070	12	14.5	1.3	1.7	11.5
Overton	37,734	6	21.3	18.5	1.1	1.7
Perry	4,791	1	19.0	5.9	6.6	6.5
Pickett	17,701	2	18.0	9.5	5.1	3.5
Polk	88,280	18	5.7	3.4	0.7	1.6
Putnam	15,066	3	46.3	8.9	10.9	26.5
Rhea	23,891	5	15.4	5.2	4.5	5.7
Roane	5,496	(Z)	26.1	5.0	9.7	11.4
Robertson	186,899	8	20.0	6.8	4.2	9.0
Rutherford	35,381	4	37.9	11.1	15.7	11.0
Scott	1,915	(Z)	20.0	8.1	7.2	4.6
Sequatchie	7,411	1	7.0	3.2	1.6	2.2
Sevier	6,423	1	31.2	7.2	17.1	6.9
Shelby	39,331	5	32.2	8.4	14.8	9.0
Smith	31,867	1	14.5	3.4	4.6	6.6
Stewart	4,188	1	30.7	7.6	14.6	8.5
Sullivan	16,741	3	23.9	8.9	9.2	5.8
Sumner	45,869	3	19.0	5.8	6.8	6.4
Tipton	112,862	8	15.9	1.6	7.8	6.5
Trousdale	6,615	1	21.9	5.7	2.9	13.2
Unicoi	825	(Z)	22.5	8.7	1.4	12.4
Union	5,354	(Z)	14.6	4.0	6.5	4.1
Van Buren	6,466	3	31.2	11.4	14.4	5.4
Warren	213,348	48	27.8	4.8	9.5	13.5
Washington	51,766	6	24.5	11.8	8.4	4.2
Wayne	45,726	7	11.7	2.5	5.4	3.9
Weakley	246,900	35	22.2	2.9	6.5	12.8
White	34,553	4	24.4	5.3	9.7	9.5
Williamson	39,881	1	23.1	10.4	6.9	5.8
Wilson	23,192	3	41.9	12.8	15.1	14.1

Table D. **American Indian or Alaska Native Producers: 2022**

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	American Indian or Alaska Native farm producers		
	Total	Individually reported [1]	Other [2]
State Total			
Tennessee	952	952	-
Counties			
Anderson	5	5	-
Bedford	15	15	-
Benton	9	9	-
Bledsoe	5	5	-
Blount	18	18	-
Bradley	4	4	-
Campbell	7	7	-
Cannon	17	17	-
Carroll	12	12	-
Carter	5	5	-
Cheatham	9	9	-
Chester	3	3	-
Claiborne	9	9	-
Clay	7	7	-
Cocke	14	14	-
Coffee	6	6	-
Crockett	1	1	-
Cumberland	3	3	-
Davidson	10	10	-
Decatur	4	4	-
DeKalb	7	7	-
Dickson	13	13	-
Fayette	14	14	-
Fentress	9	9	-
Franklin	13	13	-
Gibson	2	2	-
Giles	12	12	-
Grainger	23	23	-
Greene	32	32	-
Grundy	1	1	-
Hamblen	4	4	-
Hamilton	8	8	-
Hancock	7	7	-
Hardeman	19	19	-
Hardin	4	4	-
Hawkins	40	40	-
Henderson	7	7	-
Henry	12	12	-
Hickman	2	2	-
Houston	8	8	-
Humphreys	13	13	-
Jackson	9	9	-
Jefferson	15	15	-
Counties - Con.			
Johnson	3	3	-
Knox	8	8	-
Lauderdale	2	2	-
Lawrence	32	32	-
Lewis	5	5	-
Lincoln	25	25	-
McMinn	14	14	-
McNairy	11	11	-
Macon	8	8	-
Madison	10	10	-
Marion	3	3	-
Marshall	19	19	-
Maury	13	13	-
Meigs	1	1	-
Monroe	12	12	-
Montgomery	13	13	-
Moore	4	4	-
Morgan	4	4	-
Obion	2	2	-
Overton	12	12	-
Perry	5	5	-
Pickett	1	1	-
Polk	6	6	-
Putnam	10	10	-
Rhea	26	26	-
Roane	19	19	-
Robertson	26	26	-
Rutherford	29	29	-
Scott	1	1	-
Sequatchie	3	3	-
Sevier	2	2	-
Shelby	9	9	-
Smith	9	9	-
Stewart	9	9	-
Sullivan	4	4	-
Sumner	18	18	-
Tipton	6	6	-
Trousdale	5	5	-
Union	12	12	-
Van Buren	2	2	-
Warren	8	8	-
Washington	22	22	-
Wayne	15	15	-
Weakley	8	8	-
White	17	17	-
Williamson	6	6	-
Wilson	36	36	-

[1] Data were collected for a maximum of four producers per farm.
[2] Data represent American Indian or Alaska Native farm or ranch producers on reservations who did not report individually. Data obtained by reservation officials.