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	86,911	5,597	32.9	8.8	10.3	13.8
Land in farms ..... acres	29,978,165	769,892	29.7	2.0	7.2	20.6
Farms by size:						
1 to 9 acres ..... farms	7,270	1,062	44.0	28.3	14.3	1.4
acres	37,997	5,024	41.6	28.3	11.7	1.6
10 to 49 acres ..... farms	18,641	1,815	33.5	17.5	10.9	5.1
acres	478,735	44,739	32.2	14.0	12.2	6.0
50 to 69 acres ..... farms	4,709	386	32.5	7.9	12.4	12.3
acres	275,809	22,833	32.5	7.9	12.3	12.4
70 to 99 acres ..... farms	7,425	557	34.8	6.5	11.6	16.7
acres	607,090	45,458	34.7	6.5	11.6	16.5
100 to 139 acres ..... farms	6,406	508	32.5	4.7	9.9	17.9
acres	749,011	59,015	32.6	4.7	9.9	18.0
140 to 179 acres ..... farms	6,084	431	30.3	4.0	8.9	17.4
acres	955,951	67,852	30.3	4.0	8.9	17.4
180 to 219 acres ..... farms	4,045	308	30.4	3.1	7.7	19.5
acres	799,133	61,513	30.3	3.1	7.8	19.4
220 to 259 acres ..... farms	3,495	214	30.1	3.0	10.0	17.1
acres	830,174	51,033	30.1	3.0	10.1	17.0
260 to 499 acres ..... farms	11,795	620	31.4	2.3	10.7	18.4
acres	4,262,116	224,394	31.5	2.2	10.6	18.8
500 to 999 acres ..... farms	9,690	351	31.6	1.4	9.7	20.5
acres	6,731,262	259,362	31.4	1.4	9.4	20.6
1,000 to 1,999 acres ..... farms	5,012	317	25.8	0.6	4.1	21.1
acres	6,744,057	427,698	25.7	0.6	4.1	20.9
2,000 acres or more ..... farms	2,339	202	34.4	1.4	6.1	26.9
acres	7,506,830	519,225	29.7	0.9	3.0	25.8
Irrigated land use:						
Harvested cropland ..... farms	1,937	152	36.3	13.4	13.2	9.7
acres	256,311	22,967	32.0	2.0	8.1	21.9
Pastureland and other land ..... farms	106	19	49.1	16.1	22.6	10.4
acres	3,376	3,362	63.4	3.1	5.1	55.1
Market value of agricultural products sold $1,000	43,935,488	1,728	26.3	5.6	7.2	13.4
Farms by value of sales:						
Less than $1,000 ..... farms	19,756	2,469	25.6	11.1	10.3	4.2
$1,000	1,072	(Z)	46.7	33.7	12.2	0.8
$1,000 to $2,499 ..... farms	3,273	429	38.5	23.5	13.1	1.9
$1,000	5,357	1	38.0	23.3	12.8	1.9
$2,500 to $4,999 ..... farms	3,377	401	41.3	23.2	12.8	5.4
$1,000	12,122	1	41.0	22.8	12.6	5.6
$5,000 to $9,999 ..... farms	3,980	427	40.8	22.6	12.4	5.8
$1,000	28,553	3	40.7	22.5	12.3	5.9
$10,000 to $19,999 ..... farms	4,290	397	35.2	14.8	9.7	10.8
$1,000	61,606	6	35.2	14.3	9.5	11.4
$20,000 to $24,999 ..... farms	1,484	116	34.1	9.8	7.3	16.9
$1,000	32,870	3	34.0	9.8	7.3	16.9
$25,000 to $39,999 ..... farms	3,603	273	38.2	10.6	10.5	17.1
$1,000	115,186	9	38.2	10.4	10.5	17.2
$40,000 to $49,999 ..... farms	1,953	151	41.7	9.1	11.6	21.0
$1,000	87,383	7	41.7	9.0	11.7	21.0
$50,000 to $99,999 ..... farms	7,082	561	39.8	6.5	9.5	23.8
$1,000	516,157	40	39.7	6.3	9.5	23.9
$100,000 to $249,999 ..... farms	10,857	519	29.4	2.8	6.6	20.0
$1,000	1,788,722	85	28.7	2.7	6.5	19.5
$250,000 to $499,999 ..... farms	9,329	461	36.4	2.3	13.6	20.5
$1,000	3,339,551	176	36.1	2.3	13.6	20.2
$500,000 to $999,999 ..... farms	8,021	220	36.0	2.5	13.0	20.5
$1,000	5,704,604	182	36.1	2.4	12.6	21.1
$1,000,000 or more ..... farms	9,906	392	28.4	4.0	7.1	17.2
$1,000	32,242,303	1,716	23.0	6.3	5.8	10.9
Farms by legal status for tax purposes:						
Family or individual ..... farms	71,127	4,769	32.7	10.3	10.2	12.2
acres	20,979,662	576,811	30.2	2.6	8.1	19.4
Partnership ..... farms	5,295	379	36.4	4.5	12.9	19.0
acres	2,973,544	139,832	26.7	1.0	5.5	20.2
Corporation:						
Family held ..... farms	7,426	326	32.3	3.9	8.4	20.0
acres	5,173,880	152,992	29.3	1.0	5.8	22.5
Other than family held ..... farms	832	91	42.3	7.9	20.7	13.7
acres	308,091	18,956	31.8	2.1	13.2	16.6
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	2,231	180	30.1	6.1	8.1	15.8
acres	542,988	47,339	31.8	1.8	4.1	25.9
Tenure:						
Full owners ..... farms	53,087	4,726	32.6	12.6	10.9	9.1
acres	7,611,381	519,459	30.7	4.7	9.4	16.5
Part owners ..... farms	26,235	712	31.4	1.8	8.8	20.8
acres	19,879,828	307,014	28.8	0.8	6.0	22.0
Tenants ..... farms	7,589	310	40.8	4.3	10.7	25.8
acres	2,486,956	127,079	34.7	2.3	9.0	23.4
Producers characteristics by- [1] (see text)						
Sex of operator:						
Male ..... farms	82,265	5,354	33.8	8.7	10.7	14.4
acres	29,251,524	738,707	30.0	1.9	7.3	20.8
Female ..... farms	45,999	3,847	33.9	10.0	10.5	13.5
acres	14,232,083	609,354	30.1	2.2	7.4	20.5
Primary occupation:						
Farming ..... farms	67,629	3,259	32.5	5.6	9.2	17.7
Other ..... farms	86,051	7,941	38.6	9.7	13.1	15.7

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	687	89	30.0	8.2	11.6	10.2
	acres	239,978	32,544	16.1	2.0	7.6	6.4
Race:							
American Indian or Alaska Native	farms	87	10	14.9	2.6	1.9	10.5
	acres	30,832	9,788	2.9	0.2	0.7	2.0
Asian	farms	153	25	30.1	13.9	12.6	3.6
	acres	56,302	25,258	30.3	6.4	21.3	2.7
Black or African American	farms	38	6	28.9	8.4	4.6	15.9
	acres	7,462	448	18.8	1.3	2.0	15.5
Native Hawaiian or Other Pacific Islander	farms	29	4	37.9	11.6	24.5	1.9
	acres	15,324	522	8.9	3.8	4.8	0.3
White	farms	86,749	5,590	33.0	8.8	10.3	13.9
	acres	29,948,182	769,309	29.8	2.0	7.2	20.6
More than one race reported	farms	252	30	26.2	9.9	9.2	7.1
	acres	53,404	9,674	21.1	2.3	7.4	11.4
Military service:							
Never served or only on active duty for training in the Reserves or National Guard (see text)	producers	142,242	10,160	36.2	8.0	11.5	16.7
Active duty now or in the past (see text)	producers	11,438	934	31.2	8.2	10.5	12.5
All producers by age group [1]:							
Under 25 years	farms	2,253	290	57.1	11.8	26.5	18.8
25 to 34 years	farms	13,582	1,225	57.0	12.2	15.3	29.5
35 to 44 years	farms	21,145	1,683	46.9	8.4	15.2	23.3
45 to 54 years	farms	21,628	1,690	38.7	8.4	13.8	16.5
55 to 64 years	farms	36,792	2,558	32.4	7.9	9.9	14.6
65 to 74 years	farms	37,259	2,501	28.8	7.2	9.5	12.1
75 years and over	farms	21,021	1,349	24.7	6.3	7.5	10.8
Net cash farm income of operations:							
Farms with gains of- [2]							
Less than $1,000	farms	1,562	173	32.1	14.1	12.3	5.7
	$1,000	767	(Z)	32.6	13.9	13.7	5.0
$1,000 to $4,999	farms	4,372	439	28.5	10.0	10.3	8.2
	$1,000	12,576	1	28.8	9.6	10.4	8.9
$5,000 to $9,999	farms	3,828	345	28.3	9.7	10.2	8.4
	$1,000	28,150	3	28.6	9.6	10.3	8.7
$10,000 to $24,999	farms	7,977	606	30.1	7.5	8.9	13.7
	$1,000	135,023	10	30.1	7.3	8.7	14.1
$25,000 to $49,999	farms	8,410	568	29.8	5.3	8.5	15.9
	$1,000	308,146	21	29.9	5.2	8.4	16.2
$50,000 or more	farms	35,842	1,163	30.6	3.3	8.9	18.5
	$1,000	15,261,764	500	26.2	4.8	7.3	14.1
Farms with losses of-							
Less than $1,000	farms	1,530	173	33.5	16.2	11.7	5.6
	$1,000	805	(Z)	35.3	16.3	12.4	6.6
$1,000 to $4,999	farms	5,800	709	37.8	20.6	13.3	3.9
	$1,000	17,054	2	38.6	21.2	13.5	3.9
$5,000 to $9,999	farms	4,744	584	41.1	22.2	13.8	5.1
	$1,000	34,571	4	41.0	22.2	13.8	5.0
$10,000 to $24,999	farms	6,302	762	43.1	20.6	15.1	7.4
	$1,000	100,731	12	42.8	20.3	15.0	7.5
$25,000 to $49,999	farms	3,023	260	40.5	15.8	13.4	11.3
	$1,000	105,873	9	40.4	15.3	13.4	11.7
$50,000 or more	farms	3,521	152	37.7	5.7	9.2	22.8
	$1,000	777,589	27	39.2	5.4	9.2	24.7
Livestock and poultry:							
Cattle and calves inventory	farms	21,750	846	34.4	17.8	7.5	9.2
	number	3,517,805	68,402	31.1	7.7	7.6	15.9
Beef cows inventory	farms	17,214	689	35.0	17.6	7.4	9.9
	number	858,556	23,520	38.9	10.7	9.6	18.5
Milk cows inventory	farms	1,016	46	27.9	16.2	9.3	2.4
	number	238,087	8,444	18.6	6.0	7.3	5.3
Hog and pigs inventory	farms	5,253	605	38.1	13.4	19.2	5.6
	number	23,808,603	6,059,636	27.0	9.8	9.0	8.2
Layers inventory	farms	5,352	666	46.6	25.5	16.4	4.7
	number	43,137,355	298,830	2.1	1.5	0.1	0.5
Broilers sold	farms	693	97	47.9	26.3	18.0	3.6
	number	16,718,903	1,300,508	15.2	11.3	3.3	0.7
Aquaculture sold	farms	33	4	27.3	8.6	16.0	2.6
	$1,000	7,492	1	24.5	7.2	14.3	3.0
Selected crops harvested:							
Corn for grain	farms	44,919	1,680	35.0	3.2	8.5	23.3
	acres	12,637,070	291,239	31.0	0.9	4.7	25.3
Durum wheat for grain	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Other spring wheat for grain	farms	15	5	53.3	9.2	43.0	1.1
	acres	476	122	54.4	7.9	44.6	1.9
Winter wheat for grain	farms	293	13	36.5	3.6	8.9	24.0
	acres	14,944	1,630	34.2	2.6	11.2	20.3
Sorghum for grain	farms	14	4	35.7	12.4	7.8	15.6
	acres	918	104	14.2	6.9	3.2	4.1
Soybeans for beans	farms	36,754	1,128	25.8	4.3	21.4	0.1
	acres	9,497,898	95,673	26.8	3.4	23.1	0.4
Rice	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Cotton	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-

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	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Barley	farms	19	3	21.1	10.2	9.5	1.3
	acres	926	52	18.7	8.1	9.6	0.9
Oats	farms	1,114	71	36.2	10.9	12.2	13.1
	acres	38,678	2,163	34.3	5.6	8.7	19.9
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	25,521	1,563	30.9	20.7	9.2	0.9
	acres	1,042,174	36,956	31.2	16.4	12.1	2.8
Land in vegetables (see text)	farms	1,059	118	35.7	21.5	12.5	1.7
	acres	7,182	894	10.1	5.2	4.2	0.6
Potatoes	farms	234	32	33.3	22.1	9.8	1.4
	acres	116	9	21.1	9.4	8.4	3.3
Tomatoes in the open	farms	445	57	35.1	22.2	12.0	0.9
	acres	155	15	24.4	16.1	7.6	0.7
Sweet corn (see text)	farms	333	37	26.7	16.5	7.8	2.4
	acres	3,086	509	6.0	2.7	2.9	0.3
Lettuce	farms	161	21	39.8	23.6	14.9	1.2
	acres	34	4	31.4	20.2	10.3	0.9
Land in orchards (see text)	farms	1,027	147	43.5	20.4	18.9	4.3
	acres	3,814	437	37.2	7.7	17.1	12.3
Apples	farms	498	77	43.4	22.9	18.1	2.4
	acres	1,323	169	37.9	15.6	19.2	3.2
Grapes (including muscadine) (see text)	farms	252	30	36.5	17.3	16.8	2.4
	acres	856	102	30.9	11.9	16.0	3.0
Oranges	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Almonds	farms	9	7	44.4	36.9	6.2	1.3
	acres	2	1	37.5	28.0	8.6	0.9
Land in berries	farms	585	87	39.8	18.7	15.8	5.3
	acres	1,655	285	43.8	9.3	21.0	13.6

[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	86,911	6.4
Land in farms ..... acres	29,978,165	2.6
Farms by size:		
1 to 9 acres ..... farms	7,270	14.6
acres	37,997	13.2
10 to 49 acres ..... farms	18,641	9.7
acres	478,735	9.3
50 to 69 acres ..... farms	4,709	8.2
acres	275,809	8.3
70 to 99 acres ..... farms	7,425	7.5
acres	607,090	7.5
100 to 139 acres ..... farms	6,406	7.9
acres	749,011	7.9
140 to 179 acres ..... farms	6,084	7.1
acres	955,951	7.1
180 to 219 acres ..... farms	4,045	7.6
acres	799,133	7.7
220 to 259 acres ..... farms	3,495	6.1
acres	830,174	6.1
260 to 499 acres ..... farms	11,795	5.3
acres	4,262,116	5.3
500 to 999 acres ..... farms	9,690	3.6
acres	6,731,262	3.9
1,000 to 1,999 acres ..... farms	5,012	6.3
acres	6,744,057	6.3
2,000 acres or more ..... farms	2,339	8.6
acres	7,506,830	6.9
Irrigated land use:		
Harvested cropland ..... farms	1,937	7.9
acres	256,311	9.0
Pastureland and other land ..... farms	106	17.6
acres	3,376	99.6
Market value of agricultural products sold $1,000	43,935,488	3.9
Farms by value of sales:		
Less than $1,000 ..... farms	19,756	12.5
$1,000	1,072	17.9
$1,000 to $2,499 ..... farms	3,273	13.1
$1,000	5,357	12.7
$2,500 to $4,999 ..... farms	3,377	11.9
$1,000	12,122	11.8
$5,000 to $9,999 ..... farms	3,980	10.7
$1,000	28,553	10.8
$10,000 to $19,999 ..... farms	4,290	9.3
$1,000	61,606	9.3
$20,000 to $24,999 ..... farms	1,484	7.8
$1,000	32,870	7.9
$25,000 to $39,999 ..... farms	3,603	7.6
$1,000	115,186	7.6
$40,000 to $49,999 ..... farms	1,953	7.7
$1,000	87,383	7.8
$50,000 to $99,999 ..... farms	7,082	7.9
$1,000	516,157	7.8
$100,000 to $249,999 ..... farms	10,857	4.8
$1,000	1,788,722	4.7
$250,000 to $499,999 ..... farms	9,329	4.9
$1,000	3,339,551	5.3
$500,000 to $999,999 ..... farms	8,021	2.7
$1,000	5,704,604	3.2
$1,000,000 or more ..... farms	9,906	4.0
$1,000	32,242,303	5.3
Farms by legal status for tax purposes:		
Family or individual ..... farms	71,127	6.7
acres	20,979,662	2.7
Partnership ..... farms	5,295	7.2
acres	2,973,544	4.7
Corporation:		
Family held ..... farms	7,426	4.4
acres	5,173,880	3.0
Other than family held ..... farms	832	10.9
acres	308,091	6.2
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	2,231	8.1
acres	542,988	8.7
Tenure:		
Full owners ..... farms	53,087	8.9
acres	7,611,381	6.8
Part owners ..... farms	26,235	2.7
acres	19,879,828	1.5
Tenants ..... farms	7,589	4.1
acres	2,486,956	5.1
Producers characteristics by- [1] (see text)		
Sex of operator:		
Male ..... farms	82,265	6.5
acres	29,251,524	2.5
Female ..... farms	45,999	8.4
acres	14,232,083	4.3
Primary occupation:		
Farming ..... farms	67,629	4.8
Other ..... farms	86,051	9.2

Item	Total	Coefficient of variation (percent)
Producers characteristics by- [1] (see text) - Con.		
Hispanic, Latino, or Spanish origin ..... farms	687	12.9
acres	239,978	13.6
Race:		
American Indian or Alaska Native ..... farms	87	11.0
acres	30,832	31.7
Asian ..... farms	153	16.4
acres	56,302	44.9
Black or African American ..... farms	38	16.2
acres	7,462	6.0
Native Hawaiian or Other Pacific Islander ..... farms	29	12.2
acres	15,324	3.4
White ..... farms	86,749	6.4
acres	29,948,182	2.6
More than one race reported ..... farms	252	11.9
acres	53,404	18.1
Military service:		
Never served or only on active duty for training in the Reserves or National Guard (see text) ..... producers	142,242	7.1
Active duty now or in the past (see text) ..... producers	11,438	8.2
All producers by age group [1]:		
Under 25 years ..... farms	2,253	12.9
25 to 34 years ..... farms	13,582	9.0
35 to 44 years ..... farms	21,145	8.0
45 to 54 years ..... farms	21,628	7.8
55 to 64 years ..... farms	36,792	7.0
65 to 74 years ..... farms	37,259	6.7
75 years and over ..... farms	21,021	6.4
Net cash farm income of operations:		
Farms with gains of- [2]		
Less than $1,000 ..... farms	1,562	11.1
$1,000	767	10.8
$1,000 to $4,999 ..... farms	4,372	10.0
$1,000	12,576	9.8
$5,000 to $9,999 ..... farms	3,828	9.0
$1,000	28,150	8.9
$10,000 to $24,999 ..... farms	7,977	7.6
$1,000	135,023	7.6
$25,000 to $49,999 ..... farms	8,410	6.8
$1,000	308,146	6.8
$50,000 or more ..... farms	35,842	3.2
$1,000	15,261,764	3.3
Farms with losses of-		
Less than $1,000 ..... farms	1,530	11.3
$1,000	805	11.4
$1,000 to $4,999 ..... farms	5,800	12.2
$1,000	17,054	12.2
$5,000 to $9,999 ..... farms	4,744	12.3
$1,000	34,571	12.5
$10,000 to $24,999 ..... farms	6,302	12.1
$1,000	100,731	11.8
$25,000 to $49,999 ..... farms	3,023	8.6
$1,000	105,873	8.6
$50,000 or more ..... farms	3,521	4.3
$1,000	777,589	3.5
Livestock and poultry:		
Cattle and calves inventory ..... farms	21,750	3.9
number	3,517,805	1.9
Beef cows inventory ..... farms	17,214	4.0
number	858,556	2.7
Milk cows inventory ..... farms	1,016	4.5
number	238,087	3.5
Hog and pigs inventory ..... farms	5,253	11.5
number	23,808,603	25.5
Layers inventory ..... farms	5,352	12.4
number	43,137,355	0.7
Broilers sold ..... farms	693	14.0
number	16,718,903	7.8
Aquaculture sold ..... farms	33	11.9
$1,000	7,492	18.2
Selected crops harvested:		
Corn for grain ..... farms	44,919	3.7
acres	12,637,070	2.3
Durum wheat for grain ..... farms	-	-
acres	-	-
Other spring wheat for grain ..... farms	15	30.3
acres	476	25.6
Winter wheat for grain ..... farms	293	4.3
acres	14,944	10.9
Sorghum for grain ..... farms	14	27.1
acres	918	11.3
Soybeans for beans ..... farms	36,754	3.1
acres	9,497,898	1.0
Rice ..... farms	-	-
acres	-	-

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	-	-
	acres	-	-
Peanuts	farms	-	-
	acres	-	-
Barley	farms	19	17.3
	acres	926	5.7
Oats	farms	1,114	6.4
	acres	38,678	5.6
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	25,521	6.1
	acres	1,042,174	3.5
Land in vegetables (see text)	farms	1,059	11.2
	acres	7,182	12.5
Potatoes	farms	234	13.7
	acres	116	7.6
Tomatoes in the open	farms	445	12.9
	acres	155	9.5
Selected crops harvested: - Con. Land in vegetables (see text) - Con.			
Sweet corn (see text)	farms	333	11.0
	acres	3,086	16.5
Lettuce	farms	161	12.9
	acres	34	11.3
Land in orchards (see text)	farms	1,027	14.3
	acres	3,814	11.5
Apples	farms	498	15.5
	acres	1,323	12.8
Grapes (including muscadine) (see text)	farms	252	11.9
	acres	856	11.9
Oranges	farms	-	-
	acres	-	-
Almonds	farms	9	72.3
	acres	2	64.4
Land in berries	farms	585	14.9
	acres	1,655	17.2

[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						
Iowa	86,911	5,597	31.8	8.5	9.9	13.3
Counties						
Adair	748	69	35.7	7.4	9.3	19.0
Adams	516	24	32.0	9.5	10.6	11.9
Allamakee	1,034	92	35.1	12.9	12.1	10.1
Appanoose	655	76	32.6	15.8	12.5	4.4
Audubon	593	66	27.2	8.8	9.9	8.5
Benton	1,090	81	30.3	7.6	8.9	13.9
Black Hawk	975	84	27.4	9.5	9.2	8.7
Boone	1,008	80	28.1	9.0	8.7	10.4
Bremer	1,009	67	24.9	5.1	5.9	13.8
Buchanan	1,121	96	31.2	6.9	7.3	17.1
Buena Vista	774	53	28.5	8.4	15.8	4.3
Butler	1,063	91	27.7	7.5	8.7	11.5
Calhoun	765	62	28.5	7.5	9.0	12.0
Carroll	1,069	66	26.1	6.0	7.1	13.0
Cass	688	56	34.1	11.5	12.8	9.9
Cedar	912	52	29.0	6.6	7.8	14.6
Cerro Gordo	800	61	27.4	7.0	8.5	11.9
Cherokee	814	38	31.2	8.6	14.6	8.1
Chickasaw	1,009	56	31.8	3.0	3.6	25.2
Clarke	649	63	30.5	10.1	12.5	7.9
Clay	730	47	30.1	9.3	11.4	9.3
Clayton	1,631	171	33.1	8.9	11.1	13.1
Clinton	1,147	80	32.1	8.8	10.6	12.7
Crawford	951	57	35.7	6.7	10.1	19.0
Dallas	901	76	32.8	9.6	6.9	16.4
Davis	941	78	37.7	15.2	15.3	7.2
Decatur	666	58	33.4	11.8	15.3	6.3
Delaware	1,496	97	31.4	7.0	9.1	15.2
Des Moines	648	42	30.5	4.6	7.4	18.4
Dickinson	439	28	27.7	4.8	8.3	14.6
Dubuque	1,554	145	35.0	10.0	9.1	16.0
Emmet	404	19	21.6	5.6	8.0	8.0
Fayette	1,364	122	31.2	8.5	11.6	11.1
Floyd	989	71	27.6	5.5	5.5	16.6
Franklin	849	54	29.1	5.3	6.5	17.3
Fremont	461	26	32.7	5.3	8.4	19.0
Greene	759	41	30.5	5.0	6.8	18.7
Grundy	670	41	24.9	6.9	11.3	6.7
Guthrie	904	74	32.9	9.0	11.3	12.6
Hamilton	770	42	28.9	3.9	4.8	20.3
Hancock	860	51	29.9	3.7	5.3	20.8
Hardin	839	55	27.8	6.9	8.1	12.9
Harrison	811	52	36.8	8.6	10.1	18.1
Henry	831	46	28.3	7.6	10.2	10.6
Howard	869	66	21.6	6.5	8.6	6.5
Humboldt	580	33	33.0	3.3	7.5	22.1
Ida	456	23	24.8	7.6	7.7	9.4
Iowa	968	71	30.9	7.8	8.7	14.4
Jackson	1,131	92	36.4	10.3	9.5	16.6
Jasper	1,151	106	34.4	12.5	12.3	9.6
Jefferson	681	55	30.2	10.9	13.0	6.3
Johnson	1,212	96	33.9	9.6	11.2	13.1
Jones	991	56	34.4	11.0	10.7	12.7
Keokuk	871	55	30.1	9.2	11.0	9.9
Kossuth	1,342	75	34.7	5.1	9.2	20.5
Lee	804	72	33.7	11.6	13.7	8.4
Linn	1,416	127	33.6	12.7	12.4	8.6
Louisa	597	36	28.7	5.9	8.6	14.2
Lucas	594	56	35.2	15.5	12.2	7.5
Lyon	1,015	82	33.8	5.8	7.6	20.3
Madison	1,133	123	36.2	17.8	12.9	5.5
Mahaska	881	68	32.7	8.6	10.8	13.2
Marion	947	96	32.6	14.0	11.2	7.4
Marshall	898	73	31.6	7.9	8.3	15.4
Mills	451	53	31.8	12.0	15.2	4.6
Mitchell	798	56	31.5	6.8	9.3	15.4
Monona	669	45	43.7	6.7	13.1	24.0
Monroe	620	50	34.4	14.0	12.7	7.7
Montgomery	487	47	26.1	10.0	12.5	3.6
Muscatine	742	45	28.9	9.9	10.4	8.6
O'Brien	880	45	32.7	9.0	15.5	8.1
Osceola	559	43	31.8	7.8	11.3	12.7
Page	639	30	29.7	10.4	12.2	7.1
Palo Alto	842	64	27.9	5.4	8.8	13.7
Plymouth	1,285	97	34.7	10.4	16.1	8.2
Pocahontas	802	54	29.4	5.3	10.7	13.4
Polk	768	82	35.5	16.1	14.4	5.0
Pottawattamie	1,203	76	40.1	13.8	16.0	10.4
Poweshiek	792	65	29.7	10.3	12.7	6.7
Ringgold	612	69	35.8	15.4	13.3	7.1
Sac	863	55	25.2	5.4	7.4	12.5
Scott	711	59	32.0	11.2	11.5	9.2
Shelby	865	38	29.7	7.0	10.3	12.4

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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.						
Sioux	1,672	102	38.2	10.5	14.9	12.7
Story	1,067	89	30.8	11.4	9.5	9.9
Tama	1,056	74	28.7	8.4	10.7	9.5
Taylor	596	45	36.5	14.1	13.7	8.7
Union	587	48	34.1	14.4	15.3	4.3
Van Buren	732	63	31.9	11.4	12.0	8.4
Wapello	682	58	26.7	12.0	9.4	5.3
Warren	1,388	149	35.7	16.1	13.5	6.0
Washington	1,176	101	31.1	9.3	15.3	6.5
Wayne	732	63	33.0	10.1	9.5	13.5
Webster	907	88	33.6	5.1	7.2	21.2
Winnebago	548	52	24.1	5.0	7.7	11.5
Winneshiek	1,459	138	31.1	11.9	10.0	9.2
Woodbury	1,005	71	37.9	9.3	10.8	17.8
Worth	538	34	22.7	8.0	9.3	5.3
Wright	734	44	27.5	6.6	10.1	10.8
LAND IN FARMS (ACRES)						
State Total						
Iowa	29,978,165	769,892	29.5	1.8	6.4	21.3
Counties						
Adair	348,125	30,217	41.4	2.9	9.7	28.9
Adams	248,630	17,929	34.6	3.4	9.3	21.8
Allamakee	304,451	17,266	37.2	7.0	10.2	20.0
Appanoose	206,941	25,555	36.7	11.2	17.2	8.3
Audubon	256,116	45,120	26.0	3.5	12.8	9.7
Benton	377,259	39,459	32.7	2.4	9.3	21.0
Black Hawk	290,438	52,251	22.9	3.1	12.2	7.7
Boone	333,540	20,382	17.7	1.5	5.3	10.9
Bremer	240,688	25,472	16.9	0.3	1.2	15.5
Buchanan	361,693	56,579	24.9	0.6	2.9	21.4
Buena Vista	322,399	37,523	29.5	3.9	22.5	3.2
Butler	327,856	31,170	25.0	1.3	5.7	18.0
Calhoun	306,722	49,117	27.6	2.8	16.2	8.5
Carroll	343,933	20,435	20.9	1.6	7.9	11.4
Cass	300,521	31,569	36.4	5.0	20.1	11.2
Cedar	366,548	21,835	29.7	1.3	5.6	22.8
Cerro Gordo	336,756	25,558	24.0	1.8	8.5	13.8
Cherokee	327,342	21,964	30.0	3.4	18.3	8.3
Chickasaw	273,833	21,385	27.0	0.2	0.8	25.9
Clarke	177,968	15,581	35.0	5.2	9.5	20.3
Clay	306,922	25,089	28.1	3.5	16.1	8.5
Clayton	430,213	54,200	36.8	2.8	6.9	27.1
Clinton	352,926	15,544	29.2	2.8	9.9	16.5
Crawford	439,226	21,996	29.1	1.4	5.4	22.3
Dallas	287,842	18,502	25.3	0.4	1.1	23.9
Davis	213,870	28,654	33.3	7.1	11.5	14.8
Decatur	231,581	18,293	35.1	5.4	12.8	16.9
Delaware	345,856	16,920	32.5	2.3	8.0	22.2
Des Moines	148,881	6,172	28.4	1.2	4.6	22.6
Dickinson	161,592	20,120	23.0	1.7	7.3	14.0
Dubuque	317,983	39,454	33.8	3.5	7.6	22.7
Emmet	216,211	23,186	14.0	1.6	7.6	4.7
Fayette	429,271	31,225	33.9	3.2	12.9	17.8
Floyd	301,797	28,267	23.3	0.7	2.2	20.4
Franklin	334,656	37,159	26.5	0.8	4.1	21.6
Fremont	264,206	24,852	28.1	1.9	9.4	16.8
Greene	318,483	39,295	28.1	1.3	5.8	21.0
Grundy	320,623	25,945	23.6	2.2	16.4	5.1
Guthrie	324,037	23,540	34.2	4.4	11.1	18.7
Hamilton	367,576	27,378	14.4	0.2	0.8	13.4
Hancock	337,777	34,705	18.2	1.1	4.9	12.1
Hardin	333,515	16,012	27.4	1.8	8.8	16.8
Harrison	374,383	22,004	42.3	3.0	10.2	29.1
Henry	233,603	13,252	25.7	2.9	9.1	13.8
Howard	296,769	15,022	16.8	2.3	7.8	6.7
Humboldt	223,283	14,193	17.9	0.9	6.7	10.3
Ida	210,663	18,852	19.3	2.0	6.3	11.0
Iowa	342,212	22,457	27.4	2.8	10.0	14.6
Jackson	292,239	31,224	31.0	4.5	8.9	17.6
Jasper	439,310	46,965	33.3	1.4	4.5	27.4
Jefferson	211,552	22,491	29.4	5.1	15.5	8.8
Johnson	259,760	13,642	30.3	4.0	12.8	13.5
Jones	319,791	7,909	33.1	2.2	6.1	24.9
Keokuk	277,478	19,450	34.6	3.4	10.9	20.3
Kossuth	584,543	34,978	37.6	1.3	7.2	29.0
Lee	223,700	18,214	36.6	6.9	18.0	11.7
Linn	338,977	53,206	28.2	4.3	13.2	10.7
Louisa	188,748	27,051	23.5	1.4	6.2	15.9
Lucas	177,001	23,909	30.4	8.1	10.3	12.1
Lyon	315,316	12,134	27.0	0.1	0.6	26.3
Madison	311,851	12,755	29.4	6.6	9.6	13.2
Mahaska	304,832	19,033	29.3	0.8	3.1	25.4
Marion	240,780	37,500	31.0	7.5	16.7	6.8

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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.						
Marshall	333,581	42,355	25.8	1.6	8.6	15.5
Mills	210,969	55,080	23.0	4.4	15.6	3.0
Mitchell	255,760	24,001	30.8	1.8	7.2	21.8
Monona	406,263	47,045	40.2	2.0	8.4	29.8
Monroe	197,145	33,995	38.5	7.5	12.0	19.0
Montgomery	237,768	31,970	23.2	3.8	17.0	2.3
Muscatine	201,753	6,575	29.5	4.4	14.4	10.6
O'Brien	268,038	13,170	25.4	2.7	15.9	6.8
Osceola	198,039	31,338	18.8	2.3	9.9	6.7
Page	291,963	19,692	32.1	4.7	18.4	9.1
Palo Alto	360,741	23,714	26.5	1.4	7.6	17.5
Plymouth	544,068	44,108	35.5	3.9	19.8	11.9
Pocahontas	316,323	27,788	29.2	2.8	14.1	12.2
Polk	179,322	20,495	23.6	4.8	13.4	5.5
Pottawattamie	563,574	17,875	38.6	5.6	24.1	8.9
Poweshiek	288,668	17,565	22.8	4.4	14.7	3.7
Ringgold	311,401	39,382	39.5	9.1	13.9	16.5
Sac	344,405	28,509	23.9	1.9	9.1	12.9
Scott	201,629	59,247	19.4	2.8	9.0	7.6
Shelby	339,793	35,785	26.4	2.8	14.8	8.9
Sioux	485,793	14,831	27.6	2.4	11.1	14.0
Story	299,244	42,295	21.9	3.3	10.4	8.2
Tama	360,619	32,643	33.3	4.5	16.3	12.6
Taylor	296,690	32,301	36.5	6.8	17.5	12.2
Union	214,527	22,656	34.7	9.6	17.9	7.2
Van Buren	225,161	11,972	32.5	4.4	7.0	21.1
Wapello	195,594	18,956	23.5	5.5	10.9	7.1
Warren	296,409	34,706	32.9	7.9	14.3	10.7
Washington	298,992	37,264	27.6	3.1	16.4	8.0
Wayne	321,812	24,080	31.8	3.3	6.7	21.7
Webster	356,141	27,640	37.8	1.1	5.9	30.8
Winnebago	197,720	14,582	11.0	0.9	4.7	5.4
Winneshiek	373,151	30,114	34.2	5.5	12.6	16.1
Woodbury	468,824	30,884	36.3	2.3	7.4	26.5
Worth	162,856	13,299	17.3	2.3	10.3	4.7
Wright	369,835	11,687	24.9	2.0	10.4	12.5
SALES ($1,000)						
State Total						
Iowa	43,935,488	1,728	24.3	5.1	6.2	12.9
Counties						
Adair	260,155	38	27.8	18.0	3.0	6.8
Adams	193,303	22	39.0	7.2	7.1	24.6
Allamakee	332,999	24	32.3	11.7	11.6	9.0
Appanoose	73,720	8	35.6	10.5	16.4	8.8
Audubon	418,072	29	25.6	11.5	7.3	6.8
Benton	449,688	37	31.6	2.8	10.6	18.3
Black Hawk	451,573	56	17.4	5.4	7.9	4.1
Boone	396,037	49	17.8	1.8	5.8	10.2
Bremer	337,683	41	21.2	0.5	2.2	18.5
Buchanan	563,632	66	21.1	2.0	2.2	16.9
Buena Vista	869,401	126	17.3	10.8	4.7	1.9
Butler	469,943	58	19.1	2.7	3.1	13.4
Calhoun	494,547	68	27.4	9.7	11.1	6.6
Carroll	740,164	43	22.8	10.9	5.9	6.1
Cass	371,233	32	26.2	10.5	10.2	5.5
Cedar	490,940	54	30.6	2.7	12.5	15.4
Cerro Gordo	409,098	34	20.8	5.7	5.7	9.4
Cherokee	551,667	90	29.8	8.0	18.7	3.1
Chickasaw	503,382	67	25.8	1.0	1.3	23.5
Clarke	125,842	32	43.5	19.0	4.7	19.8
Clay	460,428	46	21.0	10.1	8.8	2.1
Clayton	522,477	38	31.5	3.6	7.9	20.0
Clinton	470,647	27	25.7	3.0	10.6	12.0
Crawford	675,228	118	26.0	4.3	9.5	12.1
Dallas	331,420	18	24.4	0.6	1.0	22.9
Davis	148,118	34	24.7	14.3	5.1	5.3
Decatur	125,243	17	18.8	12.1	2.7	4.0
Delaware	770,692	66	31.8	3.4	7.8	20.6
Des Moines	145,787	25	28.1	1.7	6.1	20.3
Dickinson	228,875	28	20.7	1.5	8.7	10.5
Dubuque	606,143	88	31.0	4.0	6.8	20.2
Emmet	375,474	20	12.8	6.2	4.0	2.7
Fayette	685,126	48	22.3	7.8	5.1	9.4
Floyd	454,385	43	17.7	1.4	1.7	14.6
Franklin	694,801	46	19.3	3.6	3.2	12.5
Fremont	245,169	26	25.0	1.5	9.3	14.3
Greene	461,030	46	28.8	3.8	6.3	18.7
Grundy	486,720	46	26.3	4.8	17.1	4.5
Guthrie	305,107	26	31.9	14.1	6.3	11.5
Hamilton	794,200	52	13.3	1.3	1.4	10.6
Hancock	674,518	52	16.2	6.9	3.2	6.1
Hardin	805,518	133	19.3	5.5	6.4	7.3
Harrison	327,669	20	41.8	5.3	14.4	22.1

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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
SALES ($1,000) - Con.						
Counties - Con.						
Henry	230,577	14	21.2	3.5	10.8	7.0
Howard	586,466	81	9.3	3.1	4.1	2.2
Humboldt	287,801	26	14.9	2.0	5.4	7.5
Ida	327,840	41	20.2	2.5	11.5	6.2
Iowa	338,793	81	27.6	5.2	9.7	12.7
Jackson	326,812	39	27.2	7.3	6.3	13.5
Jasper	483,263	49	31.5	5.0	14.8	11.7
Jefferson	153,715	9	26.4	5.5	16.9	4.0
Johnson	326,529	24	22.6	6.2	8.5	7.9
Jones	396,942	14	28.6	2.1	5.4	21.1
Keokuk	301,632	51	31.2	7.8	18.4	5.0
Kossuth	924,728	82	32.1	5.1	8.1	18.9
Lee	179,542	23	42.5	10.9	21.4	10.2
Linn	396,311	68	26.8	4.3	12.7	9.9
Louisa	261,313	85	27.9	5.0	8.6	14.3
Lucas	91,079	53	47.8	28.7	4.9	14.2
Lyon	1,258,501	83	23.4	3.2	3.6	16.7
Madison	235,510	13	18.9	9.1	3.5	6.4
Mahaska	418,035	58	24.0	2.6	4.5	16.9
Marion	154,324	31	28.6	7.7	16.2	4.7
Marshall	446,804	68	20.4	1.5	6.9	12.0
Mills	173,097	45	21.3	3.3	16.8	1.1
Mitchell	493,871	53	32.7	4.0	8.9	19.8
Monona	324,954	38	36.0	3.6	7.0	25.4
Monroe	109,965	17	20.1	17.9	1.0	1.2
Montgomery	239,115	36	18.9	8.5	9.4	1.0
Muscatine	271,312	14	30.3	11.9	12.4	5.9
O'Brien	650,332	62	27.6	8.2	15.7	3.7
Osceola	699,798	73	16.2	7.5	5.9	2.8
Page	224,937	21	32.6	4.6	23.6	4.4
Palo Alto	783,389	147	18.0	6.5	5.6	5.9
Plymouth	1,116,816	140	23.1	5.3	14.2	3.7
Pocahontas	546,119	43	18.4	6.2	6.5	5.7
Polk	161,129	22	16.1	11.6	2.9	1.6
Pottawattamie	605,310	29	39.6	11.6	20.8	7.3
Poweshiek	386,737	21	13.7	7.0	1.8	4.8
Ringgold	226,601	78	21.2	11.4	1.7	8.1
Sac	685,051	85	17.6	4.5	6.4	6.8
Scott	315,151	70	12.9	0.6	1.5	10.8
Shelby	518,776	45	21.1	4.2	10.7	6.2
Sioux	2,344,436	159	24.8	8.9	8.9	7.0
Story	386,146	81	17.7	4.7	7.6	5.4
Tama	406,434	34	34.8	6.6	18.5	9.7
Taylor	252,514	12	20.3	11.9	4.2	4.2
Union	213,347	27	23.5	12.1	5.2	6.3
Van Buren	150,001	50	28.2	13.2	8.3	6.6
Wapello	138,952	24	19.4	5.6	12.6	1.2
Warren	170,973	29	29.5	7.5	16.6	5.4
Washington	952,561	126	17.1	4.5	9.6	3.0
Wayne	146,550	10	24.2	5.2	12.5	6.4
Webster	456,685	80	32.7	4.1	4.8	23.8
Winnebago	354,055	99	7.1	2.5	2.4	2.2
Winneshiek	542,435	75	36.7	10.1	14.4	12.2
Woodbury	576,980	35	28.3	3.1	5.3	19.9
Worth	167,176	13	11.5	2.3	6.7	2.5
Wright	719,410	23	15.2	5.4	3.0	6.8

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			
Iowa	288	288	-
Counties			
Adair	2	2	-
Adams	3	3	-
Allamakee	4	4	-
Appanoose	1	1	-
Benton	2	2	-
Black Hawk	2	2	-
Boone	7	7	-
Bremer	3	3	-
Butler	1	1	-
Cass	1	1	-
Cedar	2	2	-
Cerro Gordo	2	2	-
Chickasaw	3	3	-
Clarke	9	9	-
Clay	2	2	-
Clayton	3	3	-
Clinton	6	6	-
Crawford	1	1	-
Dallas	2	2	-
Davis	2	2	-
Decatur	10	10	-
Delaware	2	2	-
Dubuque	1	1	-
Emmet	2	2	-
Fayette	4	4	-
Floyd	2	2	-
Franklin	1	1	-
Fremont	1	1	-
Greene	3	3	-
Grundy	1	1	-
Guthrie	4	4	-
Hancock	1	1	-
Harrison	1	1	-
Henry	2	2	-
Howard	1	1	-
Humboldt	2	2	-
Ida	1	1	-
Iowa	3	3	-
Jackson	5	5	-
Jasper	13	13	-
Counties - Con.			
Jefferson	2	2	-
Johnson	4	4	-
Jones	1	1	-
Keokuk	4	4	-
Lee	3	3	-
Linn	6	6	-
Louisa	1	1	-
Lucas	4	4	-
Madison	8	8	-
Mahaska	2	2	-
Marion	8	8	-
Marshall	2	2	-
Mills	3	3	-
Mitchell	4	4	-
Monona	2	2	-
Monroe	2	2	-
Muscatine	3	3	-
O'Brien	3	3	-
Osceola	4	4	-
Page	2	2	-
Palo Alto	3	3	-
Pocahontas	8	8	-
Polk	5	5	-
Pottawattamie	11	11	-
Poweshiek	6	6	-
Ringgold	3	3	-
Sac	1	1	-
Scott	3	3	-
Shelby	1	1	-
Sioux	8	8	-
Story	1	1	-
Tama	6	6	-
Taylor	3	3	-
Van Buren	5	5	-
Wapello	7	7	-
Warren	10	10	-
Washington	4	4	-
Wayne	1	1	-
Webster	3	3	-
Winnebago	1	1	-
Winneshiek	4	4	-
Woodbury	8	8	-

[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.