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	55,734	3,554	44.2	7.9	20.2	16.1
Land in farms ..... acres	44,794,702	1,079,764	33.4	2.3	18.1	13.1
Farms by size:						
1 to 9 acres ..... farms	2,539	237	62.3	21.1	28.8	12.4
acres	12,170	1,152	61.7	20.3	27.4	13.9
10 to 49 acres ..... farms	9,990	1,390	53.9	16.0	22.1	15.8
acres	273,441	38,017	53.0	15.1	22.0	16.0
50 to 69 acres ..... farms	2,531	177	45.7	11.1	16.5	18.2
acres	147,810	10,562	45.5	11.1	16.4	18.1
70 to 99 acres ..... farms	5,085	560	48.0	8.3	17.3	22.4
acres	412,496	44,984	47.9	8.2	17.3	22.4
100 to 139 acres ..... farms	3,398	289	43.8	8.0	17.3	18.5
acres	396,896	34,270	43.9	7.9	17.5	18.4
140 to 179 acres ..... farms	4,988	480	46.2	7.1	20.7	18.5
acres	785,272	75,588	46.2	7.1	20.6	18.4
180 to 219 acres ..... farms	1,883	165	40.7	6.4	20.4	13.9
acres	371,957	32,749	40.8	6.4	20.6	13.8
220 to 259 acres ..... farms	1,938	119	40.1	5.1	15.5	19.5
acres	460,313	27,917	40.1	5.2	15.5	19.4
260 to 499 acres ..... farms	6,860	226	39.1	4.2	15.8	19.1
acres	2,486,941	80,061	39.2	4.1	15.9	19.2
500 to 999 acres ..... farms	5,642	155	36.0	3.5	20.2	12.2
acres	3,995,558	114,319	36.0	3.5	20.3	12.1
1,000 to 1,999 acres ..... farms	4,722	187	38.2	2.1	25.6	10.5
acres	6,624,290	268,970	38.0	2.0	25.3	10.7
2,000 acres or more ..... farms	6,158	161	36.1	1.6	21.9	12.6
acres	28,827,558	979,467	30.3	1.4	16.3	12.7
Irrigated land use:						
Harvested cropland ..... farms	5,226	270	36.6	5.6	19.3	11.7
acres	2,307,167	134,224	28.3	1.9	18.9	7.6
Pastureland and other land ..... farms	260	22	38.5	4.7	17.0	16.8
acres	37,615	3,440	23.2	2.4	12.4	8.4
Market value of agricultural products sold $1,000	23,985,145	301	16.5	2.8	3.1	10.7
Farms by value of sales:						
Less than $1,000 ..... farms	12,829	3,237	54.7	6.5	17.7	30.5
$1,000	1,055	(Z)	54.8	22.1	27.0	5.8
$1,000 to $2,499 ..... farms	3,195	319	52.0	15.9	27.7	8.5
$1,000	5,255	1	51.8	15.7	27.8	8.3
$2,500 to $4,999 ..... farms	3,404	460	50.0	15.7	23.3	11.1
$1,000	12,265	2	50.0	15.4	23.0	11.7
$5,000 to $9,999 ..... farms	4,292	348	46.5	14.0	21.4	11.1
$1,000	30,846	2	46.4	14.2	21.9	10.3
$10,000 to $19,999 ..... farms	4,957	171	41.4	11.9	17.5	12.1
$1,000	71,112	2	41.2	11.9	17.9	11.4
$20,000 to $24,999 ..... farms	1,644	119	38.9	11.8	18.4	8.8
$1,000	36,624	3	38.9	11.8	18.4	8.7
$25,000 to $39,999 ..... farms	3,586	244	39.5	9.9	17.9	11.7
$1,000	113,570	8	39.4	9.9	17.9	11.6
$40,000 to $49,999 ..... farms	1,546	167	38.3	8.6	20.4	9.2
$1,000	69,058	7	38.2	8.7	20.5	9.1
$50,000 to $99,999 ..... farms	4,953	300	38.9	7.5	24.3	7.2
$1,000	355,294	22	38.8	7.4	24.0	7.4
$100,000 to $249,999 ..... farms	5,443	206	36.8	4.3	21.7	10.9
$1,000	878,769	40	36.8	4.2	22.0	10.6
$250,000 to $499,999 ..... farms	3,699	93	41.0	2.8	29.7	8.5
$1,000	1,332,988	38	41.3	2.8	31.4	7.1
$500,000 to $999,999 ..... farms	3,005	159	43.2	1.8	29.0	12.3
$1,000	2,155,850	126	43.4	1.6	29.1	12.7
$1,000,000 or more ..... farms	3,181	69	26.0	2.7	9.4	13.9
$1,000	18,922,459	190	9.9	1.9	0.6	7.4
Farms by legal status for tax purposes:						
Family or individual ..... farms	46,182	3,079	43.8	9.3	21.5	13.0
acres	29,131,337	877,152	34.3	2.5	20.6	11.3
Partnership ..... farms	4,067	229	47.3	3.5	16.9	27.0
acres	7,837,337	439,851	29.9	1.6	11.2	17.1
Corporation:						
Family held ..... farms	3,343	90	44.5	3.5	15.6	25.4
acres	6,515,550	504,888	33.2	2.2	16.5	14.5
Other than family held ..... farms	452	30	52.7	3.5	20.0	29.2
acres	428,547	40,694	29.6	1.5	8.7	19.4
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	1,690	192	44.6	4.6	15.4	24.6
acres	881,931	68,718	38.6	2.0	16.1	20.5
Tenure:						
Full owners ..... farms	34,206	3,438	47.0	10.1	17.8	19.1
acres	8,567,077	472,470	37.0	3.9	13.2	19.8
Part owners ..... farms	17,312	427	36.5	4.1	24.7	7.7
acres	31,670,912	718,433	31.6	2.5	20.3	8.8
Tenants ..... farms	4,216	148	53.3	3.9	31.1	18.3
acres	4,556,713	159,436	39.5	0.9	23.1	15.5
Producers characteristics by- [1] (see text)						
Sex of operator:						
Male ..... farms	52,464	3,238	44.9	7.6	20.8	16.4
acres	43,771,911	1,053,999	33.6	2.2	18.3	13.1
Female ..... farms	30,608	2,689	45.0	7.5	16.5	20.9
acres	20,150,718	924,494	32.1	1.7	14.5	15.9
Primary occupation:						
Farming ..... farms	41,342	1,494	41.8	5.5	16.8	19.5
Other ..... farms	59,313	5,551	51.3	6.2	17.9	27.2

See footnote(s) at end of table.

--continued

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

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

Item		Total	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
Producers characteristics by- [1] (see text) - Con.							
Hispanic, Latino, or Spanish origin	farms	1,095	119	51.9	9.3	26.5	16.1
	acres	762,763	78,776	32.5	1.7	13.3	17.4
Race:							
American Indian or Alaska Native	farms	511	53	38.7	11.9	24.9	2.0
	acres	384,565	79,227	31.3	5.4	24.1	1.8
Asian	farms	155	27	38.7	10.9	26.6	1.2
	acres	46,299	5,558	12.5	2.8	8.9	0.7
Black or African American	farms	123	25	37.4	8.4	28.4	0.6
	acres	63,933	23,987	43.5	1.6	41.8	0.1
Native Hawaiian or Other Pacific Islander	farms	28	7	42.9	31.8	7.4	3.7
	acres	36,809	22,454	57.1	37.9	15.9	3.2
White	farms	55,186	3,503	44.3	7.9	20.1	16.3
	acres	44,408,946	1,063,635	33.4	2.3	18.0	13.2
More than one race reported	farms	628	60	44.6	8.3	22.5	13.8
	acres	398,391	77,633	39.2	2.7	17.7	18.8
Military service:							
Never served or only on active duty for training in the Reserves or National Guard (see text)	producers	92,617	6,178	47.5	5.8	17.5	24.3
Active duty now or in the past (see text)	producers	8,038	667	46.0	7.1	15.8	23.2
All producers by age group [1]:							
Under 25 years	farms	1,724	187	69.0	6.8	20.8	41.4
25 to 34 years	farms	7,976	469	63.1	8.4	33.6	21.1
35 to 44 years	farms	12,322	528	51.8	5.6	22.6	23.5
45 to 54 years	farms	14,489	795	51.1	5.6	21.8	23.8
55 to 64 years	farms	24,171	1,876	45.6	5.5	17.4	22.7
65 to 74 years	farms	25,988	2,312	42.8	6.0	11.1	25.7
75 years and over	farms	13,985	1,270	39.8	5.7	7.3	26.8
Net cash farm income of operations:							
Farms with gains of- [2]							
Less than $1,000	farms	1,408	252	46.4	10.8	20.8	14.7
	$1,000	707	(Z)	45.8	9.8	19.9	16.1
$1,000 to $4,999	farms	4,295	559	44.6	7.8	16.3	20.5
	$1,000	12,120	2	44.2	7.5	15.9	20.9
$5,000 to $9,999	farms	3,206	306	42.3	6.8	14.4	21.1
	$1,000	23,543	2	42.4	6.8	14.5	21.1
$10,000 to $24,999	farms	5,032	329	41.8	6.2	17.4	18.2
	$1,000	82,523	5	41.7	6.0	17.7	17.9
$25,000 to $49,999	farms	3,851	157	39.0	5.7	17.7	15.6
	$1,000	138,504	6	39.2	5.7	17.9	15.6
$50,000 or more	farms	11,651	348	37.5	3.4	20.0	14.0
	$1,000	4,763,347	114	26.3	3.2	8.9	14.1
Farms with losses of-							
Less than $1,000	farms	1,559	295	50.2	11.1	22.2	16.9
	$1,000	771	(Z)	50.4	11.6	24.0	14.8
$1,000 to $4,999	farms	5,971	715	51.0	12.0	22.2	16.8
	$1,000	17,493	2	51.0	11.9	22.0	17.1
$5,000 to $9,999	farms	5,047	491	50.6	13.3	22.9	14.4
	$1,000	36,774	3	50.4	13.2	22.5	14.7
$10,000 to $24,999	farms	6,593	328	48.1	12.2	22.5	13.4
	$1,000	105,825	5	48.0	12.0	22.8	13.2
$25,000 to $49,999	farms	3,388	158	47.9	8.5	21.9	17.6
	$1,000	117,823	6	48.0	8.6	22.1	17.3
$50,000 or more	farms	3,733	133	42.0	3.6	23.8	14.7
	$1,000	670,224	25	37.1	1.7	22.2	13.2
Livestock and poultry:							
Cattle and calves inventory	farms	22,467	975	38.0	17.3	9.7	11.0
	number	6,126,402	450,771	18.1	4.1	1.4	12.6
Beef cows inventory	farms	19,848	804	37.6	17.2	10.1	10.2
	number	1,332,657	64,288	32.7	9.4	11.4	12.0
Milk cows inventory	farms	501	91	43.5	18.9	4.5	20.1
	number	176,106	20,803	4.7	0.3	(Z)	4.5
Hog and pigs inventory	farms	907	93	51.3	12.7	20.0	18.5
	number	1,907,011	159,544	12.5	2.3	3.2	6.9
Layers inventory	farms	4,371	287	51.1	15.9	25.6	9.6
	number	2,025,646	76,928	4.9	3.4	0.9	0.6
Broilers sold	farms	252	40	51.2	18.7	26.4	6.1
	number	33,822	10,204	32.7	13.1	16.2	3.4
Aquaculture sold	farms	27	10	48.1	9.9	11.2	27.1
	$1,000	2,693	(Z)	11.9	0.6	0.3	10.9
Selected crops harvested:							
Corn for grain	farms	10,767	722	36.3	4.6	20.3	11.4
	acres	4,658,341	139,456	30.9	2.7	19.2	9.0
Durum wheat for grain	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Other spring wheat for grain	farms	10	3	40.0	2.7	37.0	0.3
	acres	1,202	308	55.4	2.3	52.7	0.4
Winter wheat for grain	farms	14,518	872	39.1	5.8	32.6	0.7
	acres	6,629,153	185,511	35.7	3.4	31.2	1.0
Sorghum for grain	farms	6,944	228	41.6	4.1	27.0	10.5
	acres	2,563,880	132,487	37.3	2.5	27.2	7.6
Soybeans for beans	farms	12,411	911	31.0	14.9	14.7	1.3
	acres	4,570,912	47,554	37.2	11.6	23.7	2.0
Rice	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Cotton	farms	321	24	44.9	3.9	34.4	6.6
	acres	140,699	4,193	35.9	4.1	23.3	8.5

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	57	14	38.6	6.9	27.5	4.2
	acres	5,363	447	30.4	2.9	26.8	0.7
Oats	farms	314	16	32.5	10.4	10.6	11.5
	acres	24,639	1,685	37.5	10.1	12.1	15.3
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	22,329	2,308	35.5	13.6	19.4	2.5
	acres	2,397,302	182,453	31.3	7.2	21.0	3.1
Land in vegetables (see text)	farms	633	103	42.8	11.3	16.3	15.2
	acres	4,039	830	11.7	0.5	0.3	10.9
Potatoes	farms	177	31	36.2	9.7	11.7	14.7
	acres	2,062	710	0.9	(Z)	(Z)	0.9
Tomatoes in the open	farms	355	65	46.8	12.4	18.0	16.3
	acres	127	17	35.7	8.2	8.2	19.3
Sweet corn (see text)	farms	180	30	48.3	13.1	19.8	15.4
	acres	330	47	14.7	3.3	1.8	9.5
Lettuce	farms	130	25	46.2	12.8	16.4	16.9
	acres	25	5	44.8	15.2	18.8	10.9
Land in orchards (see text)	farms	603	170	46.8	13.4	19.7	13.7
	acres	5,361	1,630	39.9	10.7	16.8	12.5
Apples	farms	226	64	44.2	12.4	16.3	15.5
	acres	364	91	37.4	11.5	18.1	7.8
Grapes (including muscadine) (see text)	farms	218	75	54.6	14.4	22.6	17.6
	acres	711	232	53.4	9.3	14.0	30.1
Oranges	farms	-	-	-	-	-	-
	acres	-	-	-	-	-	-
Almonds	farms	7	3	42.9	26.3	13.7	2.9
	acres	1	(Z)	42.9	26.3	13.7	2.9
Land in berries	farms	198	36	43.4	10.9	17.4	15.1
	acres	197	47	45.4	3.8	18.1	23.5

[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	55,734	6.4
Land in farms ..... acres	44,794,702	2.4
Farms by size:		
1 to 9 acres ..... farms	2,539	9.3
acres	12,170	9.5
10 to 49 acres ..... farms	9,990	13.9
acres	273,441	13.9
50 to 69 acres ..... farms	2,531	7.0
acres	147,810	7.1
70 to 99 acres ..... farms	5,085	11.0
acres	412,496	10.9
100 to 139 acres ..... farms	3,398	8.5
acres	396,896	8.6
140 to 179 acres ..... farms	4,988	9.6
acres	785,272	9.6
180 to 219 acres ..... farms	1,883	8.8
acres	371,957	8.8
220 to 259 acres ..... farms	1,938	6.1
acres	460,313	6.1
260 to 499 acres ..... farms	6,860	3.3
acres	2,486,941	3.2
500 to 999 acres ..... farms	5,642	2.7
acres	3,995,558	2.9
1,000 to 1,999 acres ..... farms	4,722	4.0
acres	6,624,290	4.1
2,000 acres or more ..... farms	6,158	2.6
acres	28,827,558	3.4
Irrigated land use:		
Harvested cropland ..... farms	5,226	5.2
acres	2,307,167	5.8
Pastureland and other land ..... farms	260	8.6
acres	37,615	9.1
Market value of agricultural products sold $1,000	23,985,145	1.3
Farms by value of sales:		
Less than $1,000 ..... farms	12,829	25.2
$1,000	1,055	31.9
$1,000 to $2,499 ..... farms	3,195	10.0
$1,000	5,255	10.4
$2,500 to $4,999 ..... farms	3,404	13.5
$1,000	12,265	13.1
$5,000 to $9,999 ..... farms	4,292	8.1
$1,000	30,846	8.0
$10,000 to $19,999 ..... farms	4,957	3.5
$1,000	71,112	3.4
$20,000 to $24,999 ..... farms	1,644	7.2
$1,000	36,624	7.4
$25,000 to $39,999 ..... farms	3,586	6.8
$1,000	113,570	6.9
$40,000 to $49,999 ..... farms	1,546	10.8
$1,000	69,058	10.7
$50,000 to $99,999 ..... farms	4,953	6.1
$1,000	355,294	6.1
$100,000 to $249,999 ..... farms	5,443	3.8
$1,000	878,769	4.6
$250,000 to $499,999 ..... farms	3,699	2.5
$1,000	1,332,988	2.8
$500,000 to $999,999 ..... farms	3,005	5.3
$1,000	2,155,850	5.9
$1,000,000 or more ..... farms	3,181	2.2
$1,000	18,922,459	1.0
Farms by legal status for tax purposes:		
Family or individual ..... farms	46,182	6.7
acres	29,131,337	3.0
Partnership ..... farms	4,067	5.6
acres	7,837,337	5.6
Corporation:		
Family held ..... farms	3,343	2.7
acres	6,515,550	7.7
Other than family held ..... farms	452	6.6
acres	428,547	9.5
Other - estate or trust, prison farm, grazing association, American Indian Reservation, etc ..... farms	1,690	11.4
acres	881,931	7.8
Tenure:		
Full owners ..... farms	34,206	10.1
acres	8,567,077	5.5
Part owners ..... farms	17,312	2.5
acres	31,670,912	2.3
Tenants ..... farms	4,216	3.5
acres	4,556,713	3.5
Producers characteristics by- [1] (see text)		
Sex of operator:		
Male ..... farms	52,464	6.2
acres	43,771,911	2.4
Female ..... farms	30,608	8.8
acres	20,150,718	4.6
Primary occupation:		
Farming ..... farms	41,342	3.6
Other ..... farms	59,313	9.4

Item	Total	Coefficient of variation (percent)
Producers characteristics by- [1] (see text) - Con.		
Hispanic, Latino, or Spanish origin ..... farms	1,095	10.9
acres	762,763	10.3
Race:		
American Indian or Alaska Native ..... farms	511	10.4
acres	384,565	20.6
Asian ..... farms	155	17.3
acres	46,299	12.0
Black or African American ..... farms	123	20.6
acres	63,933	37.5
Native Hawaiian or Other Pacific Islander ..... farms	28	26.5
acres	36,809	61.0
White ..... farms	55,186	6.3
acres	44,408,946	2.4
More than one race reported ..... farms	628	9.5
acres	398,391	19.5
Military service:		
Never served or only on active duty for training in the Reserves or National Guard (see text) ..... producers	92,617	6.7
Active duty now or in the past (see text) ..... producers	8,038	8.3
All producers by age group [1]:		
Under 25 years ..... farms	1,724	10.8
25 to 34 years ..... farms	7,976	5.9
35 to 44 years ..... farms	12,322	4.3
45 to 54 years ..... farms	14,489	5.5
55 to 64 years ..... farms	24,171	7.8
65 to 74 years ..... farms	25,988	8.9
75 years and over ..... farms	13,985	9.1
Net cash farm income of operations:		
Farms with gains of- [2]		
Less than $1,000 ..... farms	1,408	17.9
$1,000	707	16.7
$1,000 to $4,999 ..... farms	4,295	13.0
$1,000	12,120	13.3
$5,000 to $9,999 ..... farms	3,206	9.6
$1,000	23,543	9.2
$10,000 to $24,999 ..... farms	5,032	6.5
$1,000	82,523	5.8
$25,000 to $49,999 ..... farms	3,851	4.1
$1,000	138,504	4.1
$50,000 or more ..... farms	11,651	3.0
$1,000	4,763,347	2.4
Farms with losses of-		
Less than $1,000 ..... farms	1,559	18.9
$1,000	771	21.3
$1,000 to $4,999 ..... farms	5,971	12.0
$1,000	17,493	10.6
$5,000 to $9,999 ..... farms	5,047	9.7
$1,000	36,774	9.4
$10,000 to $24,999 ..... farms	6,593	5.0
$1,000	105,825	4.5
$25,000 to $49,999 ..... farms	3,388	4.7
$1,000	117,823	4.9
$50,000 or more ..... farms	3,733	3.6
$1,000	670,224	3.7
Livestock and poultry:		
Cattle and calves inventory ..... farms	22,467	4.3
number	6,126,402	7.4
Beef cows inventory ..... farms	19,848	4.0
number	1,332,657	4.8
Milk cows inventory ..... farms	501	18.1
number	176,106	11.8
Hog and pigs inventory ..... farms	907	10.3
number	1,907,011	8.4
Layers inventory ..... farms	4,371	6.6
number	2,025,646	3.8
Broilers sold ..... farms	252	16.0
number	33,822	30.2
Aquaculture sold ..... farms	27	36.7
$1,000	2,693	6.9
Selected crops harvested:		
Corn for grain ..... farms	10,767	6.7
acres	4,658,341	3.0
Durum wheat for grain ..... farms	-	-
acres	-	-
Other spring wheat for grain ..... farms	10	26.8
acres	1,202	25.7
Winter wheat for grain ..... farms	14,518	6.0
acres	6,629,153	2.8
Sorghum for grain ..... farms	6,944	3.3
acres	2,563,880	5.2
Soybeans for beans ..... farms	12,411	7.3
acres	4,570,912	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	321	7.4
	acres	140,699	3.0
Peanuts	farms	-	-
	acres	-	-
Barley	farms	57	25.0
	acres	5,363	8.3
Oats	farms	314	5.2
	acres	24,639	6.8
Forage - land used for all hay and haylage, grass silage, and greenchop	farms	22,329	10.3
	acres	2,397,302	7.6
Land in vegetables (see text)	farms	633	16.3
	acres	4,039	20.5
Potatoes	farms	177	17.7
	acres	2,062	34.4
Tomatoes in the open	farms	355	18.4
	acres	127	13.4
Selected crops harvested: - Con. Land in vegetables (see text) - Con.			
Sweet corn (see text)	farms	180	16.4
	acres	330	14.2
Lettuce	farms	130	19.1
	acres	25	17.9
Land in orchards (see text)	farms	603	28.2
	acres	5,361	30.4
Apples	farms	226	28.5
	acres	364	25.1
Grapes (including muscadine) (see text)	farms	218	34.3
	acres	711	32.7
Oranges	farms	-	-
	acres	-	-
Almonds	farms	7	38.3
	acres	1	38.3
Land in berries	farms	198	18.2
	acres	197	23.6

[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 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						
Kansas	55,734	3,554	45.9	8.2	20.9	16.8
Counties						
Allen	468	36	45.5	15.9	23.1	6.5
Anderson	529	37	36.7	12.2	12.2	12.3
Atchison	496	36	45.4	12.8	24.0	8.6
Barber	393	24	49.7	5.9	21.7	22.1
Barton	575	71	44.0	7.1	21.6	15.3
Bourbon	666	38	37.1	7.5	10.8	18.8
Brown	475	27	40.9	9.5	15.1	16.4
Butler	1,399	182	51.7	14.3	22.9	14.4
Chase	252	14	47.8	7.8	26.4	13.6
Chautauqua	335	22	41.5	6.1	11.0	24.5
Cherokee	608	38	42.2	15.9	18.6	7.7
Cheyenne	401	25	41.7	3.5	20.4	17.9
Clark	264	21	49.3	4.8	21.1	23.4
Clay	449	22	45.4	10.7	14.1	20.6
Cloud	419	27	47.9	7.7	18.8	21.4
Coffey	644	91	42.1	6.6	18.0	17.5
Comanche	206	25	35.7	2.6	9.8	23.3
Cowley	879	25	49.3	10.4	24.8	14.1
Crawford	763	34	40.5	9.8	21.7	9.1
Decatur	336	26	37.6	3.9	15.2	18.4
Dickinson	810	67	43.5	13.0	19.4	11.1
Doniphan	337	9	44.5	8.0	12.0	24.4
Douglas	919	95	50.7	12.8	18.2	19.7
Edwards	233	104	31.0	4.2	14.4	12.5
Elk	255	18	44.4	13.3	26.2	4.8
Ellis	653	37	48.2	6.4	24.2	17.6
Ellsworth	327	26	37.9	5.0	8.6	24.3
Finney	563	81	53.2	4.1	27.7	21.4
Ford	536	51	49.7	6.2	21.1	22.4
Franklin	835	50	39.1	13.2	14.9	11.0
Geary	217	17	44.2	5.3	20.2	18.7
Gove	383	32	50.4	7.6	33.5	9.3
Graham	347	57	42.8	3.8	15.2	23.7
Grant	297	32	43.4	3.2	19.5	20.7
Gray	464	47	42.5	5.2	19.6	17.6
Greeley	285	22	41.1	2.8	19.1	19.2
Greenwood	489	22	47.4	11.2	26.6	9.6
Hamilton	358	63	43.6	2.8	20.7	20.1
Harper	457	42	47.3	6.6	18.3	22.4
Harvey	690	44	44.8	14.2	21.1	9.5
Haskell	199	26	46.2	2.3	36.3	7.7
Hodgeman	439	34	46.2	2.0	21.3	22.8
Jackson	783	44	42.7	15.5	16.0	11.3
Jefferson	846	69	47.0	15.4	23.9	7.6
Jewell	433	26	44.3	3.4	14.1	26.8
Johnson	613	65	56.4	14.4	24.9	17.2
Kearny	385	27	43.2	2.6	16.5	24.2
Kingman	756	69	45.0	7.4	16.9	20.7
Kiowa	352	43	49.6	4.0	26.2	19.3
Labette	842	67	41.4	17.3	14.8	9.4
Lane	287	31	48.1	1.8	24.8	21.5
Leavenworth	1,023	97	47.5	17.5	18.3	11.7
Lincoln	273	22	33.6	10.6	16.7	6.3
Linn	704	59	40.2	10.0	17.2	13.0
Logan	263	20	49.4	5.9	33.5	10.0
Lyon	826	78	45.2	10.7	24.0	10.4
McPherson	1,048	75	45.5	10.8	24.7	9.9
Marion	873	68	43.9	8.8	22.9	12.1
Marshall	708	32	45.6	13.2	14.2	18.1
Meade	397	36	45.1	5.8	22.6	16.7
Miami	1,254	121	51.0	16.0	20.7	14.3
Mitchell	372	33	46.8	11.0	28.8	7.0
Montgomery	892	48	44.0	13.0	16.7	14.3
Morris	369	50	38.9	12.6	17.6	8.8
Morton	376	78	42.0	1.8	10.1	30.1
Nemaha	834	34	47.9	14.5	20.8	12.6
Neosho	612	58	41.4	15.9	20.6	4.9
Ness	525	28	46.8	3.6	31.1	12.1
Norton	314	23	39.8	7.1	15.3	17.4
Osage	865	45	46.9	10.5	18.8	17.6
Osborne	308	27	48.5	6.9	22.4	19.2
Ottawa	401	17	43.5	10.6	18.5	14.5
Pawnee	337	20	45.3	4.9	23.7	16.7
Phillips	378	29	46.4	7.9	29.1	9.4
Pottawatomie	820	46	45.8	9.6	18.4	17.9
Pratt	517	61	46.7	3.3	16.8	26.6
Rawlins	312	20	41.2	5.0	18.2	18.1
Reno	1,543	155	52.1	8.6	25.0	18.6
Republic	470	33	47.0	11.4	24.8	10.8
Rice	433	21	46.8	7.2	14.1	25.5
Riley	424	26	49.7	3.3	30.1	16.3
Rooks	466	46	48.5	5.1	20.7	22.7
Rush	469	25	48.8	5.4	22.0	21.3

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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.						
Russell	510	82	47.9	5.0	17.1	25.8
Saline	513	30	42.2	11.5	18.4	12.2
Scott	263	83	40.4	3.3	32.2	4.9
Sedgwick	1,283	100	53.4	12.6	23.2	17.6
Seward	292	36	49.2	3.1	17.0	29.1
Shawnee	791	93	43.5	12.6	20.9	9.9
Sheridan	317	32	45.8	5.7	27.3	12.8
Sherman	373	79	46.1	3.6	18.9	23.6
Smith	447	32	49.0	7.6	23.1	18.4
Stafford	489	59	46.8	5.1	21.8	19.8
Stanton	225	34	41.3	2.7	30.2	8.4
Stevens	410	61	40.6	3.9	17.8	19.0
Sumner	1,013	59	49.5	9.5	24.8	15.2
Thomas	454	45	45.3	7.0	25.4	13.0
Trego	387	37	45.0	3.3	19.6	22.1
Wabaunsee	618	49	46.9	6.0	23.9	17.0
Wallace	285	45	46.8	3.8	27.0	16.0
Washington	642	23	49.1	11.6	19.0	18.5
Wichita	266	10	40.7	1.8	20.7	18.2
Wilson	403	25	47.4	10.3	24.9	12.2
Woodson	240	25	43.0	9.5	26.8	6.7
Wyandotte	160	22	52.5	21.9	25.2	5.4
LAND IN FARMS (ACRES)						
State Total						
Kansas	44,794,702	1,079,764	32.9	2.1	17.0	13.8
Counties						
Allen	249,954	32,496	42.4	8.6	30.4	3.4
Anderson	286,520	43,425	30.7	6.7	19.4	4.6
Atchison	193,896	59,737	40.8	11.2	24.1	5.4
Barber	723,977	114,266	28.0	2.8	15.7	9.6
Barton	562,598	43,545	30.2	2.4	13.5	14.3
Bourbon	311,422	40,203	29.0	3.8	5.7	19.5
Brown	340,917	33,106	25.7	3.2	4.4	18.2
Butler	821,264	63,741	38.2	2.1	9.6	26.6
Chase	491,365	54,782	38.6	2.3	17.9	18.4
Chautauqua	311,512	59,736	17.8	2.1	4.8	10.9
Cherokee	258,413	77,234	34.3	9.8	21.4	3.2
Cheyenne	645,026	30,210	30.2	2.4	18.7	9.1
Clark	560,252	64,653	35.3	0.9	10.1	24.4
Clay	338,106	25,108	35.5	9.5	11.1	14.9
Cloud	328,457	41,149	38.6	9.1	18.1	11.4
Coffey	314,123	63,691	33.5	5.3	15.9	12.3
Comanche	451,953	53,631	20.7	2.0	4.7	14.0
Cowley	519,270	77,922	44.8	3.9	24.8	16.1
Crawford	352,793	45,723	38.2	7.0	18.9	12.3
Decatur	514,685	71,201	33.1	4.2	23.8	5.1
Dickinson	455,551	24,390	43.6	11.4	23.7	8.5
Doniphan	154,259	22,894	29.4	4.3	8.1	17.0
Douglas	218,949	44,506	40.0	5.5	9.8	24.7
Edwards	396,962	9,881	4.2	0.5	2.5	1.2
Elk	246,966	69,857	26.0	4.6	15.9	5.4
Ellis	573,649	51,932	42.7	5.4	23.0	14.3
Ellsworth	306,934	53,245	24.7	2.9	8.4	13.4
Finney	821,433	88,708	40.1	1.8	29.9	8.4
Ford	698,533	32,088	32.4	1.1	6.8	24.6
Franklin	254,532	34,077	28.7	6.2	6.6	15.8
Geary	176,034	59,024	21.8	1.2	14.4	6.2
Gove	658,365	147,209	37.5	3.6	24.5	9.4
Graham	400,161	57,187	24.9	1.7	9.5	13.7
Grant	363,590	16,943	20.2	1.3	13.7	5.2
Gray	553,976	24,951	12.8	0.9	7.9	4.0
Greeley	495,657	20,532	25.1	1.7	14.5	8.9
Greenwood	674,590	63,850	34.2	2.8	23.5	7.9
Hamilton	637,056	32,565	26.0	2.0	14.3	9.7
Harper	444,647	75,547	36.3	7.3	18.9	10.2
Harvey	343,919	6,892	33.6	7.5	16.7	9.4
Haskell	334,602	32,062	28.3	0.9	24.3	3.1
Hodgeman	518,034	67,798	37.2	1.1	23.4	12.6
Jackson	263,210	14,535	38.8	13.9	15.2	9.6
Jefferson	187,336	22,921	29.2	8.3	16.1	4.7
Jewell	462,604	64,167	33.2	3.8	10.6	18.8
Johnson	53,247	21,503	50.2	10.3	20.5	19.4
Kearny	553,074	28,033	29.9	1.8	20.9	7.2
Kingman	450,053	43,630	34.6	5.4	17.9	11.3
Kiowa	367,358	30,241	34.1	2.5	20.5	11.1
Labette	364,342	62,753	30.6	10.6	15.3	4.6
Lane	458,845	41,121	31.0	0.6	17.6	12.8
Leavenworth	150,003	32,126	34.9	12.9	13.7	8.3
Lincoln	286,803	40,372	29.8	8.4	17.0	4.4
Linn	288,612	28,877	27.5	4.3	9.9	13.4
Logan	551,683	89,625	32.9	2.6	28.0	2.4
Lyon	469,248	51,700	37.1	7.1	19.9	10.1
McPherson	571,571	29,920	40.0	4.9	31.6	3.5

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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.						
Marion	600,561	13,363	30.4	4.0	17.4	9.0
Marshall	443,244	41,158	40.0	10.3	19.3	10.4
Meade	624,369	53,493	25.7	2.1	14.9	8.7
Miami	273,336	57,515	43.5	11.4	18.8	13.3
Mitchell	421,946	61,033	35.5	7.7	22.9	4.9
Montgomery	300,352	24,629	41.2	7.1	12.3	21.9
Morris	441,414	35,775	26.2	4.1	16.7	5.3
Morton	449,871	47,298	23.5	0.4	4.8	18.4
Nemaha	410,751	36,981	40.8	14.4	18.6	7.9
Neosho	319,747	47,682	34.6	12.5	17.9	4.2
Ness	685,153	23,849	40.7	2.2	34.1	4.4
Norton	450,829	76,356	19.8	4.1	7.6	8.1
Osage	337,246	84,248	39.5	10.1	20.0	9.4
Osborne	424,101	32,964	38.4	6.8	25.8	5.8
Ottawa	381,011	31,557	38.5	7.0	23.6	7.8
Pawnee	412,958	81,567	35.2	3.1	27.7	4.4
Phillips	460,080	37,298	30.9	5.2	21.7	4.0
Pottawatomie	404,286	42,338	33.2	8.0	12.8	12.3
Pratt	463,932	8,501	36.7	0.4	5.0	31.3
Rawlins	631,243	111,343	27.7	3.7	17.8	6.1
Reno	779,043	117,528	46.3	4.0	26.2	16.1
Republic	315,020	46,842	35.9	7.6	23.3	5.0
Rice	384,753	59,801	30.3	2.9	10.2	17.1
Riley	209,517	64,618	41.6	0.1	26.7	14.9
Rooks	567,973	45,560	35.9	4.4	15.5	15.9
Rush	337,199	51,705	47.0	4.4	32.3	10.3
Russell	432,200	80,213	40.7	4.2	17.8	18.7
Saline	314,203	43,435	36.1	10.0	17.7	8.3
Scott	458,248	24,046	7.6	0.4	6.3	0.9
Sedgwick	474,946	62,656	48.6	8.8	32.7	7.1
Seward	392,849	52,631	23.4	1.1	7.1	15.1
Shawnee	163,838	24,141	31.9	7.8	15.4	8.7
Sheridan	469,691	78,914	26.1	3.1	13.6	9.4
Sherman	674,867	228,926	24.6	0.7	5.4	18.5
Smith	551,930	60,712	38.8	3.6	25.6	9.6
Stafford	405,396	55,363	36.0	2.7	20.3	13.1
Stanton	432,788	37,187	20.7	0.9	16.9	2.9
Stevens	460,825	24,075	20.7	0.9	11.3	8.5
Sumner	750,650	14,765	40.5	6.2	28.6	5.7
Thomas	615,525	98,756	30.0	2.8	22.1	5.1
Trego	490,680	71,430	28.7	2.5	19.0	7.2
Wabaunsee	383,644	40,417	34.0	2.0	27.2	4.8
Wallace	557,058	131,106	24.9	0.7	7.9	16.3
Washington	443,162	24,346	41.1	11.3	12.5	17.4
Wichita	459,188	16,436	22.2	1.3	17.5	3.4
Wilson	289,239	74,089	45.9	6.9	27.5	11.5
Woodson	251,633	47,295	25.2	3.9	17.5	3.7
Wyandotte	9,316	1,180	29.5	9.5	14.8	5.2
SALES ($1,000)						
State Total						
Kansas	23,985,145	301	17.4	2.8	2.9	11.6
Counties						
Allen	58,880	12	45.5	7.4	34.2	3.8
Anderson	80,846	21	35.0	7.6	23.4	4.0
Atchison	108,630	31	40.7	8.8	19.6	12.2
Barber	102,259	14	35.1	3.4	30.0	1.8
Barton	491,395	7	9.7	7.0	1.5	1.3
Bourbon	77,148	13	27.7	9.2	6.2	12.3
Brown	269,186	26	26.4	5.2	6.2	15.0
Butler	344,880	27	32.3	2.8	7.7	21.9
Chase	135,076	23	27.3	1.9	19.3	6.2
Chautauqua	51,560	6	28.1	0.8	7.2	20.1
Cherokee	96,725	39	30.0	5.2	23.9	0.9
Cheyenne	183,137	5	14.0	1.3	1.3	11.4
Clark	186,224	6	8.8	2.4	1.4	5.1
Clay	151,979	12	31.7	10.6	6.6	14.6
Cloud	112,944	12	37.1	9.1	24.8	3.1
Coffey	85,673	17	30.4	5.2	11.1	14.0
Comanche	54,026	9	35.6	11.3	21.7	2.5
Cowley	116,270	19	49.4	4.2	28.7	16.5
Crawford	93,115	11	37.2	15.0	16.5	5.8
Decatur	261,838	5	8.8	6.9	1.5	0.4
Dickinson	189,962	37	34.9	14.0	17.7	3.2
Doniphan	132,080	18	28.9	8.5	13.4	7.0
Douglas	86,442	15	38.6	3.1	6.1	29.3
Edwards	318,060	18	1.6	0.1	(Z)	1.5
Elk	42,358	12	20.4	6.2	10.8	3.5
Ellis	93,501	18	48.7	8.5	35.3	4.8
Ellsworth	47,967	10	29.1	2.3	5.4	21.4
Finney	1,122,314	21	6.6	1.2	0.8	4.5
Ford	667,781	12	7.0	4.2	0.9	2.0
Franklin	126,207	18	22.8	0.4	0.3	22.0
Geary	53,639	9	19.5	0.9	9.8	8.8

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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
SALES ($1,000) - Con.						
Counties - Con.						
Gove	333,960	22	13.0	3.9	4.4	4.7
Graham	55,219	10	24.1	3.3	16.0	4.7
Grant	1,052,521	119	2.5	0.3	0.1	2.2
Gray	1,271,532	29	6.2	0.5	0.3	5.4
Greeley	266,287	5	5.9	0.6	0.5	4.8
Greenwood	162,514	24	42.8	2.5	28.8	11.4
Hamilton	516,489	5	3.1	0.4	0.1	2.6
Harper	100,242	11	41.8	10.9	22.3	8.5
Harvey	179,885	19	28.6	9.0	14.9	4.6
Haskell	1,636,349	17	2.8	0.5	0.2	2.1
Hodgeman	226,540	25	14.6	0.8	2.1	11.6
Jackson	90,610	9	44.1	18.0	15.2	10.9
Jefferson	76,958	30	29.0	9.6	16.6	2.8
Jewell	158,568	28	36.5	0.7	1.6	34.2
Johnson	19,142	7	48.2	7.6	6.9	33.6
Kearny	369,705	26	9.6	4.6	4.1	0.9
Kingman	80,802	7	38.5	7.1	25.7	5.7
Kiowa	75,400	7	32.4	2.0	23.2	7.2
Labette	157,919	13	19.0	8.8	7.6	2.5
Lane	332,189	8	6.9	1.4	2.8	2.7
Leavenworth	62,113	26	40.4	2.5	1.5	36.4
Lincoln	71,342	20	34.8	15.9	14.3	4.7
Linn	51,626	14	32.4	8.2	18.3	6.0
Logan	82,406	16	31.8	3.7	25.8	2.4
Lyon	159,558	24	45.4	12.7	26.0	6.7
McPherson	312,127	20	36.9	3.0	4.7	29.2
Marion	187,272	14	36.2	3.4	14.6	18.3
Marshall	216,572	36	41.9	12.7	23.9	5.3
Meade	390,750	19	14.9	1.3	1.8	11.8
Miami	79,358	17	49.8	4.3	10.5	35.1
Mitchell	168,865	21	29.4	13.7	13.2	2.5
Montgomery	70,645	7	36.8	10.0	9.9	17.0
Morris	126,875	14	20.5	6.1	11.0	3.4
Morton	166,609	18	8.1	1.8	1.4	4.9
Nemaha	447,989	30	31.1	5.8	13.6	11.8
Neosho	95,155	13	29.4	15.4	10.9	3.1
Ness	84,667	4	40.5	2.3	36.5	1.7
Norton	103,716	10	19.4	7.4	7.0	4.9
Osage	77,307	18	43.6	10.3	23.5	9.7
Osborne	92,525	11	44.0	4.7	38.0	1.3
Ottawa	131,545	6	35.1	12.3	19.7	3.0
Pawnee	349,762	23	11.3	7.1	3.7	0.5
Phillips	117,166	15	36.1	3.7	7.5	24.8
Pottawatomie	151,450	17	27.3	9.7	6.2	11.4
Pratt	328,653	26	17.2	2.1	0.2	14.9
Rawlins	75,745	9	29.9	6.2	18.3	5.4
Reno	399,365	22	26.0	20.5	3.5	2.0
Republic	254,210	19	22.7	8.8	9.4	4.5
Rice	297,108	13	14.6	4.8	1.4	8.4
Riley	67,019	16	33.2	0.2	18.9	14.0
Rooks	112,959	10	32.2	9.2	16.9	6.2
Rush	84,862	18	46.1	10.2	33.1	2.9
Russell	66,812	11	35.9	8.7	25.0	2.2
Saline	69,937	12	38.1	15.7	20.3	2.2
Scott	1,405,436	9	2.0	1.5	0.4	0.1
Sedgwick	175,058	50	50.1	5.6	28.2	16.3
Seward	398,022	27	6.6	0.7	0.7	5.3
Shawnee	51,738	13	39.1	12.9	16.9	9.3
Sheridan	397,304	19	7.6	6.0	1.2	0.4
Sherman	180,568	38	20.0	2.9	10.3	6.8
Smith	193,813	22	33.7	8.8	22.2	2.7
Stafford	238,120	14	14.8	1.8	11.3	1.6
Stanton	142,835	4	16.9	1.7	9.2	6.0
Stevens	400,857	15	5.7	1.8	3.7	0.2
Sumner	181,886	8	39.5	5.3	19.2	15.0
Thomas	289,137	41	19.0	7.7	6.2	5.1
Trego	68,415	8	33.1	2.7	26.4	4.1
Wabaunsee	86,015	11	40.0	1.2	37.1	1.8
Wallace	115,401	15	15.3	1.7	8.6	5.0
Washington	264,593	11	31.3	2.5	2.9	25.9
Wichita	590,279	149	2.6	1.6	0.9	0.2
Wilson	67,485	14	46.8	14.3	26.7	5.8
Woodson	73,509	15	22.1	3.1	16.4	2.5
Wyandotte	5,672	(Z)	21.3	14.1	4.9	2.3

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			
Kansas	1,195	1,195	-
Counties			
Allen	8	8	-
Anderson	4	4	-
Atchison	4	4	-
Barber	18	18	-
Barton	3	3	-
Bourbon	23	23	-
Brown	7	7	-
Butler	20	20	-
Chase	4	4	-
Chautauqua	43	43	-
Cherokee	56	56	-
Cheyenne	3	3	-
Clark	6	6	-
Clay	3	3	-
Cloud	2	2	-
Coffey	16	16	-
Comanche	2	2	-
Cowley	24	24	-
Crawford	44	44	-
Decatur	4	4	-
Dickinson	7	7	-
Doniphan	3	3	-
Douglas	6	6	-
Edwards	1	1	-
Elk	18	18	-
Ellsworth	1	1	-
Finney	13	13	-
Ford	5	5	-
Franklin	12	12	-
Geary	9	9	-
Gove	6	6	-
Graham	1	1	-
Gray	6	6	-
Greeley	6	6	-
Greenwood	15	15	-
Hamilton	4	4	-
Harper	4	4	-
Harvey	10	10	-
Haskell	3	3	-
Jackson	41	41	-
Jefferson	35	35	-
Jewell	1	1	-
Johnson	11	11	-
Kearny	13	13	-
Kingman	14	14	-

Geographic area	American Indian or Alaska Native farm producers		
	Total	Individually reported [1]	Other [2]
Counties - Con.			
Kiowa	1	1	-
Labette	88	88	-
Leavenworth	12	12	-
Lincoln	4	4	-
Linn	17	17	-
Logan	6	6	-
Lyon	6	6	-
McPherson	12	12	-
Marion	3	3	-
Marshall	3	3	-
Meade	2	2	-
Miami	28	28	-
Montgomery	120	120	-
Morris	6	6	-
Morton	10	10	-
Nemaha	2	2	-
Neosho	30	30	-
Ness	2	2	-
Osage	13	13	-
Osborne	6	6	-
Ottawa	3	3	-
Pawnee	19	19	-
Pottawatomie	4	4	-
Pratt	23	23	-
Rawlins	5	5	-
Reno	15	15	-
Rice	5	5	-
Riley	2	2	-
Rooks	5	5	-
Rush	3	3	-
Russell	2	2	-
Saline	5	5	-
Scott	1	1	-
Sedgwick	14	14	-
Seward	6	6	-
Shawnee	46	46	-
Sherman	5	5	-
Smith	5	5	-
Stanton	3	3	-
Stevens	9	9	-
Sumner	52	52	-
Thomas	4	4	-
Trego	7	7	-
Wabaunsee	9	9	-
Wallace	6	6	-
Washington	6	6	-
Wichita	2	2	-
Wilson	14	14	-
Woodson	5	5	-

[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.