

## Supporting Statement – Part B

### AGRICULTURAL RESOURCE MANAGEMENT, CHEMICAL USE, AND POST-HARVEST CHEMICAL USE SURVEYS

OMB No. 0535-0218

The information that is provided in this supporting statement serves as an overview of the sampling, statistical methodology, weighting of data for non-response, methods for increasing response rates, measurements for accuracy, testing of instruments, etc. The more detailed information for the ARMS and Chemical Use surveys can be found in the attachments to this submission.

#### **B. COLLECTION OF INFORMATION EMPLOYING STATISTICAL METHODS**

- 1. Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection method to be used. Data on the number of entities (e.g., establishments, State and local government units, households, or persons) in the universe covered by the collection and in the corresponding sample are to be provided in tabular form for the universe as a whole and for each of the strata in the proposed sample. Indicate expected response rates for the collection as a whole. If the collection has been conducted previously, include the actual response rate achieved during the last collection.**

Respondent Universe: ARMS and the Vegetable Chemical Use Surveys are screened together to identify records for sampling. The target population for ARMS is the official NASS farm population with the exclusion of institutional farms, approximately 2 million operations. The target populations for the ARMS Chemical Use (Phase II), the Fruit and Vegetable Chemical Use Surveys, and most of the Field Crop Production Practice and Chemical Use Surveys are operations that produce the commodity of interest. The respondent universe for the Contractor Expense Surveys comes from known contractors on our list frame. No screening to identify these operations is necessary.

Sampling: The ARMS is a multiple frame survey using a list frame of farms identified on the NASS list frame and a complementary area frame. Sample list strata are developed using major categories, a combination of targeted crops, livestock, fruit, vegetables, and horticulture. Strata are developed by grouping operators by the total value of sales followed by the presence of the targeted commodity. The list is an efficient sampling frame because it contains most of the farms with the largest production and economic activity. The area frame, stratified by land use, provides the completeness missing from the list. The multiple frame expansions are unbiased and more precise than expansions which could be obtained using one frame alone

The list classification process is very extensive, examining many crop and livestock control data values. After classification is completed, list records are partitioned into size groups based on qualifying control data for the current year commodities, type of farm, and estimated size. Operations will always belong to one of the standard expenditure strata and are eligible to also belong to a targeted commodity stratum.

The area frame sample consists of a subset of respondents from the June Agricultural Survey (JAS), included in OMB No. 0535-0213. During the JAS, farm operators associated with the land area segments are classified according to whether they overlap with the list frame. Those farm operators not eligible for selection on the list are eligible for selection in the ARMS area sample.

Beginning in 2007, Sequential Interval Poisson (SIP) sampling was used for some of the PPCR surveys in ARMS. Beginning in 2008, all surveys (PPCR and CRR surveys) were selected using SIP methodology. In SIP, the sampling probabilities were defined to ensure each operation was in one and only one sample. The probabilities of selection can be based on any type of probability scheme. The SIP procedure was used to minimize overlap with the previous year's ARMS sample as well as the current year's Crops/Stocks samples.

The Vegetable Chemical Use Survey is screened in the spring with the ARMS screening to identify operations with targeted crops. The sample design for the Fruit and Vegetable Chemical Use Survey is a multivariate probability proportional to size (MPPS) design. Acreage of all targeted crops that the grower reported in the screening phase or on the list frame are included when determining a grower's probability of selection.

The respondent universe for the **Maryland Pesticide Usage Survey** will include entities that applied pesticides in crop year 2018. The Pesticide Regulation Section of the Maryland Department of Agriculture maintains lists of certified applicators, businesses, and public agencies. This list of approximately 5,500 pesticide applicators will each receive a survey. To account for applicators who are not certified, an additional 1,500 farmers will be selected using random systematic sampling from the NASS list frame.

The respondent universe for the **Minnesota Pesticide and Fertilizer Survey** will include operations that planted one of the target commodities in crop year 2018. The NASS list frame will be used to identify operations based on control data. One hundred operations will be selected per county with the goal of obtaining at least 30 complete, useable reports for analysis. Random sampling is used from the NASS list frame.

The respondent universe for the **Mississippi State University Extension Service (MSUES) Field Crop Production Practice and Chemical Use Surveys** will include operations that planted one of the target commodities in

crop year 2018. The NASS list frame will be used to identify operations based on control data. Random sampling will be used from the NASS list frame. The sample will be selected for estimates by Soil Resource Region defined by Mississippi State University. The sample will be screened in after planting is complete to identify operations with one of the targeted crops. The final sample will be a subset of the screening sample. The final sample will be by crop so that each operator is assigned one crop to report on.

Response Rates: Following are average response rates for all survey phases based on the last three survey cycles.

Annual Average Response Rates					
Survey	Survey Year	Sample Size	Percent Response	Percent Refusal	Percent Inaccessible
ARMS Screening (Phase 1)	2017	111,420	55.4%	15.3%	29.3%
	2016	99,390	55.2%	15.0%	29.8%
	2015	91,451	54.9%	16.0%	29.1%
	<b>Average</b>				
ARMS Production Practices (Phase 2)	2017	17,792	68.9%	24.1%	7.0%
	2016	3,972	56.0%	32.9%	11.2%
	2015	10,513	69.7%	18.8%	11.5%
	<b>Average</b>				
ARMS Cost and Returns (Phase 3)	2017	32,657	63.9%	29.4%	6.6%
	2016	33,487	55.4%	37.7%	7.0%
	2015	37,586	52.2%	39.7%	8.1%
	<b>Average</b>				
Fruit and Vegetable Chemical Use Survey *	2016 Veg.	2,755	74.7%	17.9%	7.3%
	2017 Fruit	6,034	74.9%	16.2%	8.9%
	<b>Average</b>	4,395	74.8%	17.1%	8.1%
Contractor Expense Survey (3 year Avg.)	<b>Average</b>	87	44.1%	39.6%	16.3%

\* These two surveys normally alternate each year.

\*\* Percentages may not add to 100% due to rounding.

\*\*\* Overall average completion rate for surveys conducted in 2015 - 2017 was 57.0%

(Overall completion average for the last three years for the ARMS surveys was 57.0%)

NASS continues its efforts at reducing respondent burden while improving response rates. With the combined work of our Research and Development Division, Methods Division, Census and Survey Division, Public Affairs Office, and our Training Group, NASS is looking at what factors work for some surveys and not others. Through the use of project management techniques and building on to lessons we have learned from previous surveys and the Census of Agriculture we are able to make changes to internet versions of questionnaires to make them more user friendly, combining smaller surveys so that we can reduce the frequency of contacting the farmers, and improve on our sampling of farmers.

The NASS Public Affairs Office (PAO) promotes NASS survey efforts and educates respondents about the need and uses for the data they are asked to provide. This group has developed survey-specific materials enumerating the benefits and uses of the data gathered from the economic surveys as well as the chemical use efforts. PAO works with data users and industry leaders to provide concrete examples of instances where the data that respondents provide are used to service the respondents. They are also actively publicizing survey activities by generating and distributing news reports and drop-ins for industry publications and news outlets.

2. **Describe the procedures for the collection of information including:**
- **statistical methodology for stratification and sample selection,**
  - **estimation procedure,**
  - **degree of accuracy needed for the purpose described in the justification,**
  - **unusual problems requiring specialized sampling procedures**

**Agricultural Resource Management Survey (ARMS)** - The annual surveys collect production practices and cost of production data on selected commodities and also detailed whole farm financial information from a representative sample of farms and ranches from across the country. To accomplish this, the ARMS are conducted in three data collection phases. In many ways, the three phases can be viewed operationally as independent surveys. However, the power of the ARMS design is that data across phases are related and can be combined and analyzed. Estimated sample sizes are shown in the Supporting Statement A, item 12, table.

The ARMS Phase I is conducted from May through July, and it collects general farm data such as crops grown, livestock inventory, and value of sales. The Integrated Screening Form is used in years that we will be conducting the Vegetable Chemical Use Survey. The integrated form will be used for both the ARMS II and III surveys and the Vegetable Chemical Use Survey. These data are used to qualify or screen farms for these surveys to make sure the samples are as accurate as possible. The sample questionnaires are attached.

The ARMS Phase II is conducted from September through December. This phase collects data associated with agricultural production practices (field operations, pest management practices, etc.), resource use (pesticide applications, fertilizer and nutrient application, types of equipment used, etc.), and variable costs of production for specific commodities. The respondent is given an information booklet for each crop with code definitions and conversion tables to help complete the questionnaire. Samples of the Phase II advance letter and flyer, respondent booklets, questionnaires, and telephone quality control sheets are attached to this renewal submission.

The ARMS Phase III is conducted from December through April following the survey reference year to enable collection of full year financial data. This phase collects whole farm finance and operator characteristics information. Samples of the Phase III advance letters, respondent booklets, sample questionnaires, and telephone quality control sheets are attached. Some of these respondents will be asked to complete a commodity-specific report to obtain financial, resource use, and cost of production data for the selected commodity and the entire farming operation. It is vital that operators who are selected for both the second and final phase complete both phases, so that we can collect data for the entire crop production process (physical activities and financial costs). Data from both phases provide the link between agricultural resource use and farm financial conditions; this is a cornerstone of the ARMS design. The commodity-specific versions consist of the Core questionnaire with appropriate customization of questions with a general scope as shown in example crop and livestock questionnaires.

As questionnaires are updated each year to accommodate changes in the farming conditions for that year or for a particular commodity, the final versions will be submitted to OMB as they become available.

**Vegetable Chemical Use Survey** - The vegetable survey targets operators with selected commodities. Vegetable operations are screened as described above. Only active operations with the crops of interest become part of the population for the fall survey.

Vegetable producers selected for the survey are asked to complete an interview with questions pertaining to whole farm acreage and production, chemical products used and application rates, pest management practices, organic practices, and operator characteristics. Collection of vegetable chemical use data begins in early October. Samples of the questionnaire versions, along with advance letters, respondent booklets, and a telephone quality control sheet are attached.

**Fruit Chemical Use Survey** - The fruit survey targets operators with selected commodities. Fruit operations are sampled from the NASS List Frame. Only active operations with the crops of interest become part of the population for the fall survey.

Fruit producers selected for the survey are asked to complete an interview with questions pertaining to whole farm acreage and production, chemical products used and application rates, pest management practices, organic practices, and operator characteristics. Collection of fruit chemical use data begins in early October. Samples of the questionnaire versions, along with advance letters, respondent booklets, and a telephone quality control sheet are attached.

**Contractor Expense Surveys** - These surveys are used to collect average contractor expenses for the five commodity groups (layers, turkeys, hogs and pigs, broilers and starter pullets, and processed vegetables). The sample size will vary from State to State, dependent upon the number of contractors and the amount of influence they each have on the market in their respective States.

NASS Regional Field Office staff will receive a Survey Administration Manual which provides detailed aspects of the survey data collection and editing process. Field enumerators in each State will be given an Interviewer's Manual.

The **Maryland Pesticide Usage Survey** will be typically conducted from March through May after the reference year. This survey will collect data from certified applicators, businesses, and public agencies for the amount of each chemical applied per county. Licensed applicators have this information in records. A questionnaire sample is attached to this submission.

The **Minnesota Pesticide and Fertilizer Survey** will be typically conducted from February through June after the reference year. This survey will collect data from the operator for

- The amount of each chemicals and fertilizers applied, and
- Management practices for chemicals and fertilizers.

Operators in Minnesota typically have this information in records. Follow-up contacts to custom applicators will be done for operators who custom hire pesticide or fertilizer applications. Interviewing will be done by Computer Assisted Telephone Enumeration only. A questionnaire template is attached to this submission.

The screening phase of the **MSUES Field Crop Production Practice and Chemical Use Surveys** will be typically conducted in August of the reference year. The production practice and chemical use survey phase will be typically conducted from October through December of the reference year. This survey will collect data from operators for agricultural production practices (field operations, pest management practices, etc.), resource use (pesticide applications, fertilizer and nutrient application, types of equipment used, etc.), and variable costs of production for specific commodities. Interviewing will be done by personal enumeration. Questionnaire samples for each commodity is attached to this submission.

The second phase of the **MSUES Field Crop Production Practice and Chemical Use Surveys** will be typically conducted in October and November of the reference year. This survey will collect data from operators for agricultural production practices (primarily field operations), resource use (pesticide applications, fertilizer and nutrient application, types of equipment used, etc.),

and limited costs for specific commodities. Interviewing will be done by personal enumeration. Questionnaire samples for each commodity is attached to this submission. Additional financial data provided by Mississippi State University will be incorporated into the practices data collected from this survey for the enterprise budgets.

- 3. Describe methods to maximize response rates and to deal with issues of non-response. The accuracy and reliability of information collected must be shown to be adequate for intended uses. For collections based on sampling a special justification must be provided for any collection that will not yield "reliable" data that can be generalized to the universe studied.**

Based on previous studies, NASS feels that the best tool for increasing response rates is improving the training of our field enumerators. Enumerators who are better prepared to answer questions raised by respondents and to inform respondents of the importance of the data and how it will be used have had the best success rates. These data are very important to both the farming community as well as external data users (politicians, educators, banking industry, farm supply companies, etc.).

**RESEARCH:** Findings from the 2007 NASS research report, *Assessing the Effect of Calibration on Non-response Bias in the 2005 ARMS Phase III Sample Using Census 2002 Data*, are summarized in the next two paragraphs.

Records sampled for the 2005 ARMS Phase III were matched with those from the 2002 Census of Agriculture, and means of census data were calculated for matching records which had also provided 2002 expenditure data for the census. Nonresponse bias in ARMS data was assessed, using census data as a proxy, in terms of the degree to which the mean based on all sample cases versus respondent cases differed. Three means were computed and compared across 20 regions in order to assess relative bias: 1) the mean of all matching cases using base sampling weights, 2) the mean for only matching ARMS respondents using the same base sampling weights, and 3) the mean for matching ARMS respondents using the sampling weights as adjusted through calibration.

Using 17 "study variables," relative bias of means was assessed using a variation of the formula provided by OMB in Guideline 3.2.9. Although significant biases were exhibited in 9 of 17 variables using the 2005 ARMS III base sampling weights, the 2005 ARMS III calibration weights were able to reduce the bias so that it was no longer significantly different from zero ( $p < .05$ ) in 16 of the 17 study variables. For this analysis the calibration process varied slightly from that of the 2005 ARMS III, in that egg and milk production were not included, since they were not accounted for by the 2002 Census; this may in part account for the one variable, fertilizer expenses, still demonstrating a significant level of bias after the use of calibrated weights. This study suggests that the process of calibration is an effective tool in reducing nonresponse bias levels.

Research is underway to see if sample size reductions can be gained using more advanced calibration techniques during ARMS phase III summarization processes.

Several research projects will be launched based on recommendations of the National Academies of Sciences, Committee on National Statistics (NAS-CNSTAT) comprehensive review of the ARMS. Copies of the November 2007 report are available via the web at:

[http://books.nap.edu/openbook.php?record\\_id=11990&page=R1](http://books.nap.edu/openbook.php?record_id=11990&page=R1).

The ARMS Progress Report that describes the actions NASS has taken to test the recommendations of the NAS are attached to this renewal request as a supplementary document. It can also be found online at the following link:

[http://www.nass.usda.gov/Surveys/ARMS\\_Progress\\_Report.pdf](http://www.nass.usda.gov/Surveys/ARMS_Progress_Report.pdf).

The high priority areas focus on respondent burden reduction strategies, response rate improvement, and improvement of data quality. Recommended action items may impact other NASS surveys as well as the next Census of Agriculture.

**The following are the non-response adjustments for ARMS II and Chemical Use.**

Unit non-response in the Vegetable Chemical Use Survey as well as ARMS II is accounted for using reweighting. The records are stratified by State and size group, and a non-response adjustment is calculated as the sample size divided by the number of completed reports. This process redistributes the survey weights for the non-respondents to the usable records. For ARMS II, the weights are then scaled so that the expanded total of the target commodity's planted acres is equal to the planted acreage number set by the ASB (Agricultural Statistics Board). For the Vegetable Chemical Use Survey a calibration program adjusts the weights so that the expanded planted acreage totals for each target crop match the planted acreage set by the ASB.

1

Item non-response in ARMS II and the Vegetable Chemical Use Surveys is handled with mean imputation. Missing fertilizer and pesticide rates are replaced with average rates by State, commodity, and product code (or nutrient in the case of fertilizer rates). If no records exist in that category, then the groups are collapsed. No other items in these surveys are imputed.

**The following are non-response adjustment for ARMS III.**



Non-response is taken into account in the ARMS III sample allocations by State. ARMS III sets a target for positive usable responses by State and ARMS Region; the sample size is adjusted based on a 5-year historical response rate to achieve the targeted usable rates.

Unit non-response in the ARMS III weights, for all versions, is adjusted by using calibration. The calibration process modifies the survey weights so that certain targets are met. NASS uses official estimates of farm numbers, corn, soybean, wheat, cotton, fruit, and vegetable acres as well as cattle, milk production, hogs, broilers, eggs, and turkeys as calibration targets.

Item non-response for the ARMS III surveys is dealt with by using machine imputation. Data collectors do not impute item values in the field. About 300 survey variables that are critical to NASS analysis and/or ERS work are imputed using usable data from current survey respondents. A multivariate imputation scheme is used and covariates come from several different components of the questionnaire including but not limited to: region, economic sales class, type of farm, acreage and production expenses. Imputed item values are flagged for data users, and the algorithms for imputation are described in technical documents that will be available to data users.

Contractor expenses are imputed from the data collected with the Contractor Expense Survey.

NASS deploys several data collection evaluation and monitoring tools. These tools enhance NASDA data collection tactics producing maximum positive impact on coverage/calibration. Real-time NASDA data collection oversight allows for flexibility of collection tactics and an improvement in survey quality metrics. Over several years, results from these survey monitoring tools are blended into a cohesive ARMS III data collection strategy, tailored to each State.

**The following are the non-response adjustments for Maryland Pesticide Usage Survey.**

Unit non-response in the Maryland Pesticide Usage Survey will be accounted for using reweighting. The records will be stratified by county and sector (certified applicators, businesses, and public agencies), and a non-response adjustment will be calculated as the sample size divided by the number of completed reports. This process redistributes the survey weights for the non-respondents to the usable records.

1

Item non-response in Maryland Pesticide Usage Survey will be handled by hand imputation from similar operations.

**The following are the non-response adjustments for Minnesota Pesticide and Fertilizer Survey.**

Unit non-response in the Minnesota Pesticide and Fertilizer Survey may be accounted for. This decision will be made depending on timing and survey budget. NASS will calculate the sampling and non-response weights for the Minnesota Department of Agriculture. An explanation will be included in the survey results to document the decision and any effects.

1

Item non-response in Minnesota Pesticide and Fertilizer Survey will be handled by hand imputation from similar operations.

**The following are the non-response adjustments for MSUES Field Crop Production Practice and Chemical Use Surveys.**

Unit non-response in the MSUES Field Crop Production Practice and Chemical Use Surveys will be accounted for using reweighting. The records will be stratified by soil region and stratum, and a non-response adjustment will be calculated as the sample size divided by the number of completed reports. This process redistributes the survey weights for the non-respondents to the usable records.

1

Item non-response in MSUES Field Crop Production Practice and Chemical Use Surveys will be handled by hand imputation from similar operations.

**4. Describe any tests of procedures or methods to be undertaken.**

NASS uses an OMB-approved generic clearance docket (OMB Control # 0535-0248), to conduct testing and evaluation of most NASS questionnaires. In this PRA approval request, NASS is including an allowance to conduct a total of 50 cognitive test interviews (annually) on the various questionnaires included in this docket. If a different method of testing is necessary or a larger sample is needed, NASS will submit a request using the generic clearance docket (0535-0248). The generic testing docket allows for a variety of testing methods, including cognitive testing, focus groups, split sample field tests, etc., that can be used to test ARMS and other NASS surveys. NASS does not plan to create a cognitive laboratory facility due to the geographic dispersion of farm operators needed for testing. As is typical in establishment surveys, most testing is conducted with onsite visits.

NASS plans to conduct cognitive interviews for all major changes that are proposed for the ARMS and Chemical Use Surveys. These interviews would address specific questions and sections to assess modified content and formatting.

Web-based data collection is available for the ARMS I and ARMS III survey samples nationally. Additionally, Computer Assisted Personal Interviewing (CAPI) began in fall 2009 and is available for all enumerators to use.

NASS has experience from previous chemical use and economic surveys that have been beneficial in designing the surveys explained in this docket. Pre-testing of restructured or rotated in sections of questionnaires will be done annually for each survey, refining the data collection instruments each year. The results of these tests and subsequent methods will be incorporated into the operational design.

In the past few years, NASS has collected a large portion of the ARMS Phase III sample through the mail. NASS will continue to improve the questionnaire to make it more user-friendly for self-administered data collection. This will be done by reviewing data from previous years and conducting cognitive testing and usability testing to meet this goal.

Data from the Contractor Expense Survey that is included in this approval request, is used to impute data for operations that could not or would not provide expenses that were conducted under a contract agreement.

Response improvement techniques will continue to be researched and tested to improve response rates in the area of questionnaire improvement, respondent relationship building, and soft refusal conversion techniques.

In 2016 NASS implemented methodology to identify the 100 most impactful respondents in terms of their contribution to the final estimates. NASS Survey Administrators have recommended our Regional Field Offices to contact these operations in person to collect the data.

- 5. Provide the name and telephone number of individuals consulted on statistical aspects of the design and the name of the agency unit, contractor(s), or other person(s) who will actually collect and/or analyze the information for the agency.**

The sampling plans are developed by NASS. Questionnaire design, data edit, and initial summarization will also be completed by NASS, and for the ARMS surveys, these tasks will be done in consultation with ERS.

Survey design and methodology are determined by the Summary, Estimation, and Disclosure Methodology Branch, Statistics Division; Branch Chief is Jeff Bailey, (202)720-4008.

Sample sizes for each State are determined by the Sampling, Editing, and Imputation Methodology Branch, Methods Division; Branch Chief is Mark Apodaca, (202)720-5805.

Data collection is carried out by NASS Regional Field Offices; Jay Johnson is the Field Operations Director (202)720-3638.

The NASS survey statisticians in Headquarters listed below are responsible for coordination of sampling, questionnaires, data collection, and other Field Office support. Branch Chief is Gerald Tillman, (202) 720-3895; Section Head is Torey Lawrence (202) 720-5921.

The NASS commodity statisticians in Headquarters listed below are responsible for national summaries, analysis, and publication. Branch Chief is Jody McDaniel, (202) 720-6146, Section Heads are Tony Dorn (202) 690-3223 and Scott Shimmin (202) 720-0684.

<b>Survey</b>	<b>Survey Statisticians</b> Census and Survey Division, Survey Administration Branch, Environmental and Economic Surveys Section	<b>Commodity Statisticians</b> Statistics Division, Environmental, Economics and Demographics Branch, Economic, and Environmental and Demographics Sections
ARMS I Screening	Pam Coleman (202) 720-6564 Max Lord (202) 720-3598	Vacant
ARMS II	Pam Coleman (202) 720-6564 Max Lord (202) 720-3598	Doug Farmer (202) 720-7492
ARMS III	Max Lord (202) 720-3598 Pam Coleman (202) 720-6564	Mike Mathison (202) 720-3243 Stephen Habets (202) 720-9168
Fruit Chemical Use	Charles Russell (202) 720-2149 Shareefah Williams (202) 690-3692	Doug Farmer (202) 720-7492
Vegetable Chemical Use		
Contractor Expense Survey	Max Lord (202) 720-3598	Mike Mathison (202) 720-3243 Stephen Habets (202) 720-9168

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