

Bento Box Questionnaire Testing: Multi-Method Questionnaire Testing for the 2012 Census of Agriculture

Jaki S. McCarthy and Donald Buysse
USDA's National Agricultural Statistics Service,
3251 Old Lee Highway, Fairfax, VA 22031

Abstract

A traditional Japanese bento box is a meal constructed according to principles of balance – separate compartments contain different colors, flavors, and cooking methods to provide an optimum eating experience. As in the bento box, questionnaire testing methods can be combined to provide a balanced questionnaire evaluation. This way, complementary methods can be used to compensate for any methods' shortcomings. In order to overcome the shortcomings of various methods of testing and capitalize on each method's strengths, NASS is conducting a multi-phase, multi-method approach to the revision and testing of the 2012 Census of Agriculture report form. Questionnaire testing will combine information from expert reviews, analysis of data from the 2007 Census of Agriculture, pre-test cognitive interviews, multiple large scale field tests and follow-up cognitive interviews. Each compartment of our testing bento box is discussed as well as how these methods are balanced to develop the best possible questionnaire for the 2012 Census of Agriculture.

Key Words: Questionnaire Testing, Cognitive Interview, Pretesting, Census of Agriculture

1. Introduction

The U S Department of Agriculture's National Agricultural Statistics Service (NASS) conducts the Census of Agriculture (COA) every five years. The COA collects an extensive set of data and produces county level statistics on agricultural production, inventory, economics and operator demographics. Including all known or potential agricultural operations, it is the largest data collection conducted by NASS. Following years ending in 2 and 7, the COA form is mailed to approximately 3 million addresses. The data is primarily collected via self administered forms returned by mail. The form is lengthy; for 2012 it is expected to be 24 pages long.

As with any large ongoing data collection, there are always improvements that can be made before the next data collection period. In preparation for the 2012 Census of Agriculture, NASS is using multiple methods of testing in the redesign and testing of the form and data collection procedures. The overall objectives of the testing are to improve the accuracy of the data collected, make reporting easier for respondents, increase the number of responses received while minimizing costs. By combining different methods in the testing we hope to gain more information and to strengthen the overall redesign efforts. This can be thought of as a “Bento Box” approach to questionnaire testing.

Bento Boxes

A bento box is a traditional Japanese meal prepared according to 5 buddhist principles (each with five elements):

- * **Goho** (five methods): simmer; steam; grill; fry; raw.
- * **Goshiki** (five colors): red; yellow; green; black; white.
- * **Gomi** (five flavors): salty; sour; sweet; bitter; spicy.
- * **Gokan** (five senses): sight; hearing; smell; taste; touch
- * **Gokan no mon** (five viewpoints)

Any ingredients can be used, but if the box contains all of these elements it should be a well balanced and nutritious meal.

2. Methods

Our testing bento box (Figure 1) contains five different methods of testing: evaluation of historical data, expert reviews, cognitive testing, field testing, and follow up testing.

2.1 Expert Reviews:

In early 2009 a NASS team began initial work reviewing input from a number of groups of experts. These included recommendations from an external panel review of the census program conducted by the Council on Food, Agricultural and Resource Economics, recommendations from NASS’s advisory committee, suggestions from both formal and informal contacts with commodity organizations, data users and subject matter experts, and routinely collected feedback from NASS staff following the previous (2007) COA. Each of these expert groups provided both specific and general comments on potential improvements to the form and the processes used in data collection.

2.2 Evaluation of Historical Data:

Initial work by the testing team also included a review of the data that had been collected in the 2007 COA. For each item on the questionnaire, the number of times the item had been edited, either by the processing programs or by an analyst, was tabulated, as was the number of times the item had been missing and imputed. The items then were rank ordered by both the number and percent of edits and imputations. This clearly indicated items that were good candidates for evaluation, redesign and improvement. Also reviewed was the record of calls that

had been made to the toll free telephone help line during the 2007 COA. For anyone who called requesting help completing their form, the section of the form they needed help with and (usually) a narrative comment was collected. In this way, we also had a ranking of the sections where most help was requested and information on why the respondent had called.

2.3 Cognitive Testing:

Once forms had been revised and newly proposed content had been added, the draft questionnaires were tested in cognitive interviews. As is usual in cognitive testing, the samples were small, approximately 40 interviews, with respondents chosen who would report data in new sections, who would report items identified as problematic, or who were thought to be representative of other census respondents. During these interviews, respondents reported data and then answered follow up questions about their reporting processes and interpretation of terms. Interviews were conducted in multiple states, with multiple kinds of respondents and with specially trained interviewers.



Figure 1. The Questionnaire Testing Bento Box

2.4 Field Testing:

Following the review of 2007 data and initial cognitive testing, initial revisions were made to the form and a small field test was conducted in early 2010. Approximately 5000 forms were mailed out using procedures similar to normal operational data collection. A larger field test will also be conducted in early 2011, with a sample of 30,000 mailed forms after additional revisions. Each field test will include several split sample comparisons. These will include different versions of individual question layout or formats, alternative cover letters, alternative reminders, or other possible changes to the data collection techniques. After each round of the field testing we will examine response rates and the data reported. This will measure data obviously reported in error (e.g. inconsistency between items, unreasonable values), rates of missing data and a review of other suspicious data.

2.5 Follow Up Interviews:

Following each round of the field test, a subset of approximately 200 respondents will be recontacted, asked to review their reported data and then asked to verify or expand on their reports. The objective of these interviews will be to explain questionable data, and verify that reasonable data is accurate. For example, respondents who report land rented but do not report paying any cash rent will be

asked if they are renting the land under some other type of rental arrangement. In addition to verifying data, follow up interview respondents will also be asked about their use of the instruction sheet, their reaction to on-line reporting, their overall experience, etc.

3. Flavors

The five types of information that are gained in the testing can be thought of as the five flavors in our bento box. They include:

- *Representative empirical counts of problems*: these are provided by a review of the historical data, and the field tests;
- *Hand selected counts of problems*: cognitive and follow up interviews will also provide counts, which can be used to compare items or tested alternatives, but these are not representative of any specific population;
- *Respondent problem details*: the comments from the telephone help line, open ended responses from cognitive and follow up interviews will all provide rich narrative descriptions of respondents' problems. However, these will be very idiosyncratic, and again cannot be used to estimate the prevalence of problems in the population;
- *Narrative opinion*: the expert reviews are an unstructured and subjective source of information; and,
- *Response rates*: we will be able to calculate response rates from both rounds of the field testing.



Figure 2. Bento Boxes are well balanced, but also often CUTE!

Each of these “flavors” provides something useful and unique to the testing process.

4. Colors

The five perspectives that are provided can be thought of as the five colors in our testing bento box. There are five distinct and quite different sources for the information we will evaluate.

- *Agricultural operations, generally*: in the cognitive interviews, field testing and follow up interviews, we will include a wide cross section of agricultural operations, representative of the respondents in the census of agriculture;
- *Specific types of agricultural operations*: operations with particular items of interest such as rented land, specialty livestock, operations reporting on-line, etc. will be specifically included in the samples used for the cognitive

interviews, field testing and follow up interviews. We do not expect these operations to be representative of all operations, but each should have unique perspectives that have the potential to impact the data collected from the subgroups of operations like them;

- *NASS headquarters staff*: some of the expert reviews will come from subject matter experts within NASS. In addition, the review of the historical data will be done by NASS staff involved in the previous census of agriculture. Past experience with NASS data collection of similar items can help identify or avoid potential data quality problems. Also, NASS HQ questionnaire design staff will revise the census questionnaire, in part, based on their experience with questionnaire design in other data collections.



Figure 3. Bento boxes can be constructed in endless ways, limited only by the maker's creativity.

- *External agricultural group representatives*: experts from outside NASS, from the NASS advisory committee, commodity organizations, academia, and data users have provided input into the census revisions;

- *NASS field staff*: following every major data collection, including the census of agriculture, each NASS field office will submit comments and suggestions for any part of the process where they feel improvements can be made. These are also reviewed to help determine the revisions to the questionnaires and data collection procedures.

It's clear that people coming from these different groups will have a variety of types of information and feedback to offer. Some of the information we gain from them will be overlapping, but some will be unique and

based on their experience and perspective. Based on the perspective and information available to the respective sources, the information offered and the priority of suggestions will differ. It has already been clear that these disparate perspectives are complementary and each add unique elements to the overall test.

5. Senses

The methods of collecting the information used in our testing can be viewed as the five senses. They include:

- *Self structured reports from groups*: information from the external groups is provided in whatever format they choose. They choose what information is included, what is important to them and may not focus on all areas of interest to the team;

- *Structured reports from groups*: input from the NASS staff is collected via a formal process, so this results in a much more structured set of information. Specific parts of the data collection and processing are outlined as appropriate for comments and this system is familiar to NASS staff as it is also used for all NASS surveys;
- *Computed from raw data*: empirical counts and comparisons are generated from the historical data evaluation. These represent the entire set of operations included in the census;
- *Interviews, open ended questions*: the cognitive interviews and some of the follow up interview questions are open ended, enabling the respondents to provide whatever information they wish. We usually have some expectation of what answers might be provided, but information that was not anticipated by anyone on the team is also expected;
- *Interviews, closed ended questions*: the field tests and follow up interviews also include closed questions with specific answer formats, which can be tallied to gauge the extent of problems.

Again, by using these different methods we hope to be able to learn information that would be impossible to gain had we used only one or two of these methods.

6. An Example of How the Principles of Five Worked Together

Leading up to the first set of questionnaire revisions, we reviewed the data from the 2007 (previous) census of agriculture. This showed that the “Acreage” and “Land” sections of the questionnaire, where the number of acres the farm operates is collected, was edited at a higher rate than most of the other items on the form. The 2 series of questions related to land are show in Figures 4 and 5 and appeared on facing pages in the 2007 questionnaire.


		None	Number of Acres
1.	All land owned.	0043 <input type="checkbox"/>	<input type="text"/>
2.	All land rented or leased from others , including land worked by you on shares, used rent free, in exchange for services, payment of taxes, etc. Include Federal, State, and railroad land leased on a per-acre basis. Exclude land (i.e. private, Federal, State, railroad, etc.) used on a per-head or animal unit month (AUM) basis under a grazing permit. . . .	0044 <input type="checkbox"/>	<input type="text"/>
3.	All land rented or leased to others , including land worked on shares by others and land subleased.	0045 <input type="checkbox"/>	<input type="text"/>
4.	TOTAL ACRES in this operation for this census - Add items 1 and 2, then subtract item 3. If the entry is zero, please refer to the enclosed Instruction Sheet, section 1. These acres are referred to as THIS OPERATION for the remainder of this report. 		
		0046	<input type="text"/>

Figure 4. 2007 Acreage section: Land by ownership questions

In addition, while there were over 30 sections in the questionnaire, when respondents called on the telephone help line asking for help completing the 2007 form, they asked for help with the Acreage and Land sections 23% of the time. There were also several comments about suspect data in the Acreage and Land questions from the field office staff who reviewed data in 2007. For example, the comment, “Acres appeared to be reported multiple times in this section and it often did not equal acres reported on the previous page,” was submitted by one of our field staff through our post census review system. The empirical counts of problems, supported by comments from field staff clearly showed this was an area of the form ripe for improvement.

Based on our initial set of information, we revised the forms with the objectives of making it clearer how the total acre figures were to be computed, clarifying what was to be included and excluded from each item, and using differences in font sizes to emphasize the overall structure of the section. The revised sections of the forms are shown below in Figures 6 and 7.

Because the COA data is primarily collected with a self administered form, we tried to visually simplify the form. We also tried to structure the form so action

SECTION 2 LAND	
Report how the acres reported in SECTION 1, item 4 were used in 2007. Include land in CRP, WRP, and other State and Federal programs. Exclude land rented to others. Report land only once, in the first item that applies. For example: Land that was both pastured and had a crop harvested should be reported only in cropland harvested (item 1a).	
1. Cropland - Exclude cropland pasture.	
a. Cropland harvested - Include all land from which crops were harvested or hay was cut, all land in orchards, citrus groves, vineyards, berries, and nursery and greenhouse crops, Christmas trees, and short rotation woody crops. 0787	None <input type="checkbox"/> Number of Acres <input type="text"/>
b. Cropland on which all crops failed or were abandoned - Exclude land in orchards and vineyards. 0790	<input type="checkbox"/> <input type="text"/>
c. Cropland in cultivated summer fallow. 0791	<input type="checkbox"/> <input type="text"/>
d. Cropland idle or used for cover crops or soil-improvement but not harvested and not pastured or grazed. 1062	<input type="checkbox"/> <input type="text"/>
2. Pasture	
a. Permanent pasture and rangeland - Exclude cropland pasture. 0796	<input type="checkbox"/> <input type="text"/>
b. Woodland pastured. 0794	<input type="checkbox"/> <input type="text"/>
c. Cropland used only for pasture or grazing - Include rotation pasture and grazing land that could have been used for crops without additional improvements. 0788	<input type="checkbox"/> <input type="text"/>
3. Woodland not pastured - Include woodlots, timber tracts, and sugarbush. . 0795	<input type="checkbox"/> <input type="text"/>
4. All other land - Include land in farmsteads, buildings, livestock facilities, ponds, roads, wasteland, etc. 0797	<input type="checkbox"/> <input type="text"/>
5. TOTAL ACRES - Add the acres reported in items 1 through 4 above. Should be the same acres as those reported in SECTION 1, Item 4. . . . 0798	<input type="checkbox"/> <input type="text"/>

Figure 5. 2007 Land Section: Land by type questions

was required from the respondent rather than simply hoping they would read everything printed on the page. In addition, we converted sentences to bullets to make these easier to read. A verification question was added which was intended to encourage respondents to correct their figures if they were reported incorrectly.

This contrasts to the 2007 questionnaire which simply stated the relationship between items on the form but did not explicitly require action from the respondent to verify or correct them. Thus, the revised form took the respondent through a series of steps that had to be completed on the form to compute acreage totals and verify they had been computed correctly.

Cognitive interviews of the revised form indicated that respondents did not have any problems computing their total acres (Box D in figure 6.) In addition, when some (though not all) respondents did report incorrectly in the Land section, they did go back and correct their data after answering the verification question at the bottom of that section. At the time of this writing, the first mail out field test data is still being analyzed, so we do not yet have any results to show whether the revised form is an improvement over the 2007 form. However, plans are to compare counts of the number of edits and imputation required for these items to similar operations in the 2007 COA. In addition, the follow up interviews after the field test will include a verification of what respondents reported, including an explanation for any data that is inconsistent or appears to have been reported more

1. Enter the number of acres owned 0043	BOX A
2. Enter the number of acres RENTED or LEASED FROM OTHERS 0044	BOX B
<u>INCLUDE</u> • land worked by you on shares • land used rent free in exchange for services, payment of taxes, etc. • Federal, State, and railroad land leased on a per acre basis	<u>EXCLUDE</u> • land used on a per-head or animal unit month (AUM) basis under a grazing permit.
3. Enter the number of acres RENTED OR LEASED TO OTHERS 0045	BOX C
<u>INCLUDE LAND</u> • worked on shares by others • subleased	<u>EXCLUDE acres enrolled in:</u> • Conservation Reserve Program (CRP) • Wetlands Reserve Program (WRP) • Farmable Wetlands Program (FWP) • Conservation Reserve Enhancement Program (CREP)
4. Enter the figures from the boxes above to determine your total acres operated:	
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px;">BOX A</div> <div>+</div> <div style="border: 1px solid black; padding: 5px;">BOX B</div> <div>=</div> <div style="border: 1px solid black; padding: 5px;">BOX D</div> </div>	

Figure 6. Revised Acreage Section

than once in this section. Similar evaluation of the rest of the form with information from the various types of tests and information sources will also be conducted.

Based on the results of the first mail out with its follow up interviews, we will conduct another round of revisions (hopefully small ones) in order to finalize the form for the second larger mail out field test. In this second field test the main emphasis will be on testing of alternatives to data collection procedures and materials, rather than the form. This will include alternative cover letters, reminders, methods of contact, etc. with the goals of increasing both overall and on-line response rates. With a larger mail out we hope to be able to test a number

of alternatives and gain good information on how procedures will perform in the census proper.


SECTION 2 LAND	
Of the acres reported in Box D , report acres in the first item that applies. REPORT LAND ONLY ONCE.	
1. Cropland - Exclude cropland pasture.	
a. Cropland harvested	
<u>INCLUDE</u> • land from which crops were harvested or hay was cut • orchards and vineyards • nursery and green house crops	• Christmas trees • citrus groves • berries • short rotation woody crops 0787
	None <input type="checkbox"/>
b. Cropland on which all crops failed or were abandoned - Exclude land in orchards and vineyards. 0790	
	<input type="checkbox"/>
c. Cropland in cultivated summer fallow 0791	
	<input type="checkbox"/>
d. Cropland idle or used for cover crops or soil-improvement but not harvested and not pastured or grazed. 1062	
	<input type="checkbox"/>
2. Pasture	
a. Permanent pasture and rangeland - Exclude cropland pasture. 0796	
	<input type="checkbox"/>
b. Woodland pastured 0794	
	<input type="checkbox"/>
c. Cropland used only for pasture or grazing - Include rotation pasture and grazing land that could have been used for crops without additional improvements 0788	
	<input type="checkbox"/>
3. Woodland not pastured	
<u>INCLUDE</u>	
• woodlots	
• timber tracts	
• sugarbush 0795	
	<input type="checkbox"/>
4. All other land	
<u>INCLUDE LAND</u>	
• in farmsteads and buildings	
• livestock facilities	
• ponds	
• roads	
• wasteland, etc. 0797	
	<input type="checkbox"/>
5. TOTAL ACRES - Add items 1-4 to determine your total acres operated. 0798	
BOX E	
 <div> <p>Does the total in Box E = the total in Box D?</p> <p><input type="checkbox"/> Yes - Continue</p> <p><input type="checkbox"/> No - Please go back and correct your figures. These numbers should be the same.</p> </div>	

Figure 7. Revised Land Section

7. Viewpoints

The final bento box principle is the five “viewpoints” which you are to take as you eat the meal. This relates to the state of mind of the team throughout the testing process.

- *Ponder deep gratitude for the people who prepared the meal:* since the team both “prepares” and “eats” the meal, this may seem unnecessary. But it is important to remember to show appreciation for the work that the team does throughout the process.
- *Perform deeds and have thoughts worthy of receiving such nourishment:* throughout the testing process, each type of testing should be taken seriously and treated as an integral and important part of the overall process.
- *Partake of the food with no ire:* this is a principle that is important as the questionnaire and procedures are being developed. There are always team members or others with definite ideas on how questions should be asked and what will work best. This is sometimes based on solid evidence, but often is the result of experience and (often conflicting) subjective opinion. “Ire” can easily creep into meetings, but this is seldom productive. We tried throughout the process to treat all input as valid and keep the tone of meetings and discussions positive and professional.
- *Realize that eating this food is feeding the soul as well as the body:* it was important also to remember that the testing process was not an end in and of itself. It is easy to begin to see each individual task as the next goal, but lose sight of the reason we are conducting all of the testing. The “soul” of the testing is to improve the data in the census, ultimately serving our data users and the public with better information.
- *Be seriously on the road to enlightenment:* clearly the testing that we have done and continue to do is taking us toward process improvements for the future. We have reviewed and incorporated much information into changes and will have a good idea of what to expect in the 2012 Census of Agriculture.

We have not yet completed the testing, but are confident that combining all of the methods of testing into the overall testing process will yield substantial benefits. From our past experience we know that limiting testing activities to one or a few methods will provide information, but often that information is incomplete. For example, a data review can indicate areas where data appears inconsistent or inaccurate; but without additional feedback from respondents it is often impossible to understand why errors occur. In contrast, cognitive interviews can directly examine respondents’ response processes and identify areas where respondents may not interpret questions as intended or may not have the requested information available. Small scale cognitive testing does not provide information on the magnitude of identified problems and is not practical for questionnaires with hundreds of variables, but can identify reasons for errors.

Similarly, expert reviews of editing, item imputation or of the questionnaire may elicit potential reasons for respondent errors, but such reviews are quite subjective and heavily influenced by the expert's particular past experiences. Field tests with the full questionnaire can help to verify if changes to particular items has decreased the amount of editing required for items identified by the experts.

Multiple sources of information can provide the well balanced view of the errors and opportunities for improvements in the census – we're not there yet, but are well down the road to enlightenment.



Figure 8. A well constructed bento box is a thing of beauty – YUM!