Micronesica Supplement 7: 41–53, 2003

Concept Test of Value-added Root Crops

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Abstract—A concept test was conducted to assess local awareness of traditional root crops and to study the market potential for value-added products made from taro (*Colocasia esculenta* (L.) Schott), sweetpotato (*Ipomoea batatas* (L.) Lam). and cassava (*Manihot esculenta* Crantz). The test design was a self-evaluating survey that was used to explore (1) the level of consumption of chips and baked/fried foods, (2) the interest level of foods made from root crops, and (3) the level of interest of "Made in Guam" products. One hundred thirty respondents between the ages of 18–54 representing Guam's consumer population were analyzed in a survey that was conducted from March to May 2000. The most popular type of value-added product was sweetpotato chips, followed by sweetpotato bread, cassava cake, cassava pudding and cassava tamales. Of the 130 persons surveyed, 72% had consumed sweetpotato within the past three months, while more than 60% had eaten cassava and 55% had eaten taro. Results suggest that there is a market potential for value-added foods made from these tropical root crops. The survey also shows that there is interest in "Made in Guam" foods.

Introduction

Important root crops in Guam include suni or taro, *Colocasia esculenta* (L.) Schott, kamuti or sweetpotato, *Ipomoea batatas* (L.) Lam. and mendioka or cassava, *Manihot esculenta* Crantz. These crops are used in local Chamorro dishes in Guam and are also important staples in other Micronesian islands. In addition to their value to the indigenous culture, the great potential of these root crops as processed products is now recognized. Examples of value-adding post-harvest activities include peeling, slicing, packaging and freezing (Barber & Cruz 1996). To develop high quality, marketable value-added products, it is necessary to eval-

uate the interest level of consumers for the processed produce. In this study we chose to conduct an exploratory concept test. The test was designed to address the specific objectives of the market study and to serve as a guide for further surveys in related studies.

The concept test in this study was conducted to obtain information on:

- consumer's frequency of eating chips and preference of chip brand and flavor,
- frequency of eating baked/fried goods and favorite types of baked/fried goods,
- taro, sweetpotato, cassava consumption,
- interest level in trying to eat taro, sweetpotato, and cassava foods,
- interest level in "Made in Guam" foods,
- demographics (gender, age and ethnic group).

This report presents data on consumer awareness and the perception of value-added foods made from taro, sweetpotato and cassava on Guam.

Materials and Methods

Questionnaire

The questionnaire was made up of 19 questions, and divided into six sections (Appendix 1). The questionnaire was constructed with the minimum possible number of questions necessary to address project objectives. The first three sections examined the general consumption level of chips and baked/fried foods and the preference of chips, type, brand, and flavors. The fourth section was designed to determine the consumption and interest level of taro, sweetpotato, and cassava. The fifth section determined the level of interest in "Made in Guam" products. In the final section, respondents provided demographic data including age, gender, and ethnic background.

Survey Method

Surveys were conducted at the University of Guam campus and at the Chamorro Village, the Bunny Market in Dededo, the Pacific Star Hotel, and at the Agana Shopping Center. The survey period extended from March through May 2000 and lasted for approximately one day at each location. Survey sites were selected targeting consumers representing the urban population in northern central locations of Guam. The sample consisted of residents between the ages of 18–54, young active residents, young professionals and the working middle class, who were more likely to buy processed or snack foods. Convenience or Judgment sampling was used to select the required number of subjects from the quota categories (Wallonich 2001).

During the survey people were approached by survey administrators and asked to answer a questionnaire. Volunteers were then given a self-reporting questionnaire. The survey administrators gave a brief explanation of the questions and assured that personal information, such as their name, address, and income was

Table 1. Summary of sampling and data collection.

Sampling Frame:	Resident population of Guam aged 18–54
Type of Sample:	Convenience Sample
Screening Criteria:	Qualified respondents: • Were 18–54 years of age • Those present at selected locations
Sample Size:	130
Date Collected:	Concept Test questionnaire covering: • Frequency of eating chips, and baked/fried foods • Preference of chip types, brands, and flavors • Consumption level of root crops • Interest level of value added products • Interest level of eating "Made in Guam" foods
Survey Period:	March to May 2000

not required. We tried to achieve a response rate undistorted by the person's desire for anonymity and confidentiality (Wallonich 2001).

Data Sampling

360 surveys were completed and sorted into quota categories of age, gender, and ethnic groups. From the total, a sample of 130 respondents between the ages of 18–54 years in age was selected to represent Guam's working population. This group was also considered potential buyers of root crops and value-added products. The "age" category was divided into four groups, ages of 18–24 (27.7%), 25–34 (28.5%), 35–44 (26.1%) and 45–54 (17.7%). Guam's population was skewed slightly towards females (51%) over males (49%). In the "ethnicity" category, Chamorro (46%) constituted the largest group, followed by Filipino (39%), Micronesian other than Chamorro (8%), Caucasian (5%), Asian (5%), and others (5%). A summary of sampling methods and a list of data collected in the survey is shown in Table 1.

Convenience and Judgement sampling was used in this preliminary research in the effort to get a gross estimate of the results without incurring cost or time required (Wallonich 2001). Three socioeconomic categories identified as important factors for sampling were age, gender, and ethnicity. The sample was a reflection of Guam's population reported by the Bureau of Labor Statistics, Guam Department of Labor, 1999.

Statistical Analysis

Sample data were analyzed using the Statistical Package for the Social Sciences (1999). Each question was set up as a variable and numbers was assigned for responses of each variable. The resulting summary included the number of respondents, and percentage and/or mean ratings for each survey question. Frequency tests and cross tabulations on selected items were also conducted to determine significant differences between gender, age and/or ethnic groups.

Significant differences among mean interest levels of value-added foods were determined by performing multiple comparisons using a Bonferroni test.

Conducting the Survey

Questionnaire design, sample size, and site locations were major factors in achieving an effective survey (Meilgaard, et al. 1991). In this concept test the information gathered was used to assess Guam's consumption level, and interest level of three root crops, taro, sweetpotatoes, and cassava.

Results and Discussion

Consumption of chips and baked fried goods

Out of 130 respondents, 80% said that they consumed chips at least once a month (Fig. 1). Eighteen percent of respondents consumed chips three or more times per week, and 25% ate chips at least once or twice a week. One out of every twenty persons do not really eat chips. Barbecue flavored chips and nacho flavored corn chips were the favorite type of chips.

Nearly 95% of respondents had eaten baked/fried goods at least once or more a month (Fig. 2). Thirty seven percent of respondents consumed baked/fried goods three or more times a week, and 29% ate them at least once or twice a week. Bread, cookies and cake were the most popular baked/fried goods. Baked/fried goods were consumed slightly more often than chips. This result may have been because there were a variety of foods in the "baked/fried goods" category.

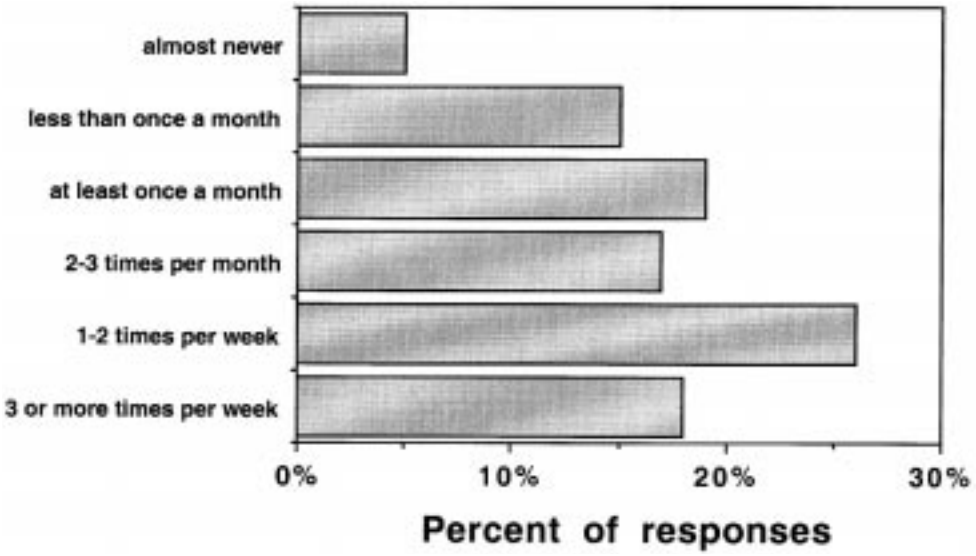

Figure 1. Frequency of eating chips on Guam as the response of the concept test question 1: "How often do you eat chips?" Quota sample = 130, between ages of 18–54. (Bureau of Labor Statistics, Guam Department of Labor. 1999).

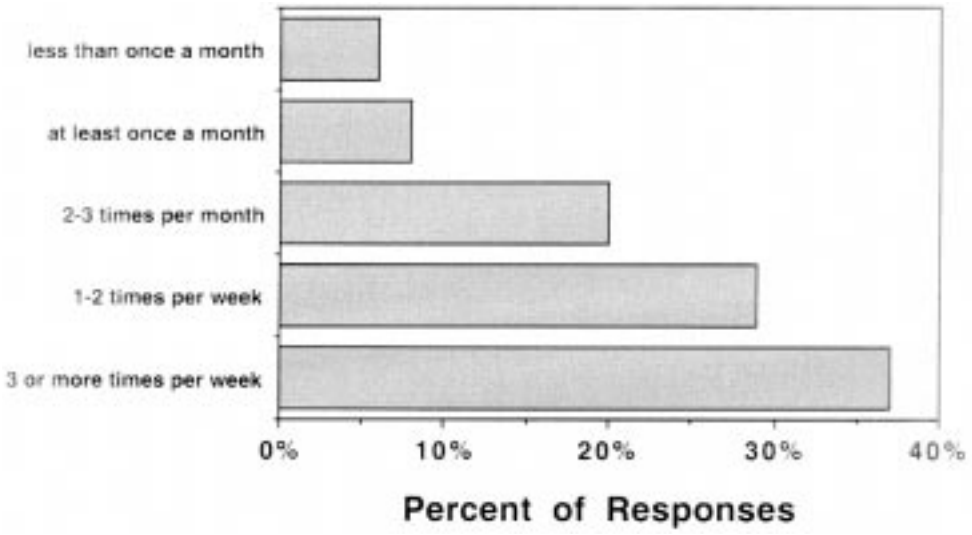

Figure 2. Frequency of eating baked/fried goods on Guam as the response of the concept test question 5: "How often do you eat baked/fried goods?" Quota sample = 130, between ages of 18–54. (Bureau of Labor Statistics, Guam Department of Labor. 1999).

Processed foods such as chips, and baked/fried goods were very popular among consumers in Guam. This popularity may allow marketing of similar types of processed foods, as the consumer population is already familiar with similar products.

Taro

Consumption—The survey suggested that Chamorro and Micronesian people were the main taro consumers. Of the 130 respondents in the survey, nearly 55% had eaten taro within the last three months (Table 2). A nearly equal number of males and females had eaten taro. Nearly 61% of respondents within the 45–54 age group had consumed taro. In the ethnicity category, two groups, Chamorro and Micronesians consumed taro more often than the entire sample population (54.6%). Among Chamorros, 60% of respondents had eaten taro within the last three months. Among Micronesians, 90% "yes" responses indicated they had eaten taro. Filipinos, the second largest ethnic group, 46% had eaten taro which is less than the average rate consumption of the total sample population. Although the sample size of Caucasian and Asian group was too small to draw definite conclusions, the two groups did not consume much taro.

Interest Level—A list of six common food items made from taro were presented to the participants to determine their interest level in eating them. The list included bread, chips, donuts, pancakes, tamales, and poi. Taro bread received the highest interest level, while pancake held the lowest (Table 3). Micronesians were most interested in poi. Food plays an important role in the cultural pattern of var-

Table 2. Taro consumption on Guam categorized by gender, age, and ethnic group.

Category	Number of "Yes" responses	% of "Yes" responses within each category
Gender:		
Male (64)	32	50.0
Female (66)	39	59.1
Age:		
18–24 (36)	19	52.7
25–34 (37)	21	56.8
35–44 (34)	17	50.0
45–54 (23)	14	60.9
Ethnic Group:		
Chamorro (60)	36	60.0
Filipino (39)	18	46.2
Micronesian (11)	10	90.9
Caucasian (7)	1	14.3
Asian (6)	1	16.7
Other (7)	5	71.4
Total sample population (130)	71	54.6

Numbers in parenthesis indicate the number of participants in each category.

Table 3. Interest level of eating taro foods by gender, age, and ethnic group.

Category	Type of taro foods						Average within each category
	Bread	Chips	Donut	Pancake	Tamales	Poi	
Gender:							
Male (64)	3.34	3.31	3.30	3.13	3.11	3.11	3.22
Female (66)	3.14	3.15	2.62	2.73	3.14	2.89	2.95
Age:							
18–24 (36)	3.08	2.97	2.97	3.03	2.72	2.94	2.95
25–34 (37)	3.14	3.24	2.76	2.70	2.95	2.92	2.95
35–44 (34)	3.15	3.09	2.97	2.76	3.29	3.21	3.08
45–54 (23)	3.78	3.83	3.22	3.35	3.78	2.91	3.48
Ethnic Group:							
Chamorro (60)	3.43	3.48	3.28	3.22	3.65	2.98	3.34
Filipino (39)	2.72	2.92	2.49	2.67	2.54	2.49	2.64
Micronesian (11)	3.73	2.64	2.45	2.45	2.27	4.45	3.39
Caucasian (7)	3.00	3.00	3.14	2.57	2.71	3.29	3.00
Asian (6)	3.50	3.67	3.33	3.50	3.00	3.33	2.95
Other (7)	3.71	3.57	3.00	2.43	3.71	3.14	3.25
Total sample population (130)	3.24a*	3.23ab	2.95ab	2.92b	3.12ab	3.00ab	3.08

Mean rating based on a scale of 1–5, 1=Not Interested, 5=Very Interested. Numbers in parenthesis indicate the number of participants in each category. *Means followed by different letters are significantly different ($P \leq 0.05$) according to Bonferroni multiple comparison test.

Table 4. Sweetpotato consumption by gender, age, and ethnic group.

Category	Number of "Yes" responses	% of "Yes" responses within each category
Gender:		
Male (64)	43	67.2
Female (66)	50	75.8
Age:		
18–24 (36)	27	75.0
25–34 (37)	28	75.7
35–44 (34)	19	55.9
45–54 (23)	19	82.6
Ethnic Group:		
Chamorro (60)	42	70.0
Filipino (39)	30	76.9
Micronesian (11)	10	90.9
Caucasian (7)	3	42.9
Asian (6)	4	66.7
Other (7)	4	57.1
Total sample population (130)	93	72.0

Numbers in parenthesis indicate the number of participants in each category.

ious societies (Dalquest 1972). Results of this survey showed that respondents favored familiar foods. For example, tamales, a local Chamorro desert held the highest interest for the Chamorro group.

Sweetpotato

Consumption—Of the 130 respondents, nearly 72% had eaten sweetpotato within the last three months (Table 4). Sixty-seven percent of male respondents had eaten sweetpotato, and 76% of females had eaten sweetpotato. The oldest age group (45–54) had consumed more than the population average. Among Chamorros and Filipinos, 70% or more had eaten sweetpotato. Before WWII, every Chamorro home had a sweetpotato garden. Sweetpotato was plentiful and was used in a variety of ways such as in turnover piecrusts from boiled mashed potatoes, or sliced and fried into chips. In addition, both sweetpotato tips and roots are used as ingredients for the local Chamorro stew "kadu" (E. Camacho, College of Agriculture and Life Sciences, UOG. personal communication). Over 90% of Micronesians had eaten sweetpotatoes, which was the highest percentage of any ethnic group.

Interest Level—A list of six common food items made from sweetpotato were presented to the participants to determine their interest level in trying them. The list included bread, chips, pancakes, cookies, cake, and pie. Sweetpotato chips received the highest interest level among 130 respondents, while cookies were of least interest (Table 5). The 45–54 age group generated the highest interest level for sweetpotato bread and chips. Respondents were also willing to try eating sweetpotato bread and pie. All ethnic groups answered that the interest

Table 5. Interest level of eating sweetpotato foods by gender, age, and ethnic group.

Category	Type of sweetpotato foods						Average within each category
	Bread	Chips	Pancakes	Cookies	Cake	Pie	
Gender:							
Male (64)	3.70	3.91	3.38	3.23	3.31	3.70	3.54
Female (66)	3.33	3.42	2.89	2.83	2.92	2.98	3.06
Age:							
18–24 (36)	3.08	3.31	3.17	2.83	2.83	2.86	3.01
25–34 (37)	3.73	3.89	3.16	2.97	3.24	3.43	3.40
35–44 (34)	3.38	3.53	2.82	3.03	3.00	3.44	3.20
45–54 (23)	4.04	4.04	3.48	3.43	3.52	3.78	3.72
Ethnic Group:							
Chamorro (60)	3.65	3.77	3.40	3.28	3.23	3.53	3.48
Filipino (39)	3.15	3.49	2.79	2.62	2.90	2.87	2.97
Micronesian (11)	3.64	3.55	2.55	3.27	3.45	3.82	3.64
Caucasian (7)	3.86	3.29	3.00	3.14	3.14	3.57	3.38
Asian (6)	3.83	4.00	4.00	3.17	3.33	3.50	3.33
Other (7)	3.57	4.00	3.00	2.57	2.57	3.14	3.14
Total sample population (130)	3.52a*	3.66a	3.13bc	3.03bc	3.12bc	3.34ab	3.30

Mean rating based on a scale of 1–5, 1=Not Interested, 5=Very Interested. Number in parenthesis indicates the number of participants in each category. *Means followed by different letters are significantly different ($P \leq 0.05$) according to Bonferroni multiple comparison test.

Table 6. Cassava consumption on Guam categorized by gender, age, and ethnic group.

Category	Number of "Yes" responses	% of "Yes" responses within each category
Gender:		
Male (64)	32	50.0
Female (66)	48	72.7
Age:		
18–24 (36)	22	61.1
25–34 (37)	25	67.6
35–44 (34)	18	52.9
45–54 (23)	15	65.2
Ethnic Group:		
Chamorro (60)	35	58.3
Filipino (39)	27	69.2
Micronesian (11)	7	63.6
Caucasian (7)	0	0.0
Asian (6)	6	100.0
Other (7)	5	71.4
Total sample population (130)	80	62.0

Numbers in parenthesis indicate the number of participants in each category.

Table 7. Interest level of eating cassava foods by gender, age, and ethnic group.

Category	Type of cassava foods			Average within each category
	Cake	Pudding	Tamale	
Gender:				
Male (64)	3.53	3.73	3.44	3.57
Female (66)	3.52	3.21	3.36	3.36
Age:				
18–24 (36)	3.31	3.36	2.89	3.19
25–34 (37)	3.57	3.51	3.46	3.51
35–44 (34)	3.47	3.29	3.38	3.38
45–54 (23)	3.87	3.83	4.13	3.94
Ethnic Group:				
Chamorro (60)	3.72	3.88	3.90	3.83
Filipino (39)	3.74	2.95	2.87	3.19
Micronesian (11)	2.64	3.00	3.36	3.50
Caucasian (7)	2.14	2.57	2.14	3.00
Asian (6)	3.33	4.00	3.17	2.28
Other (7)	3.57	4.00	3.57	3.71
Total sample population (130)	3.52a*	3.47a	3.40a	3.46

Mean rating based on a scale of 1–5, 1=Not Interested, 5=Very Interested. Numbers in parenthesis indicate the number of participants in each category. *No significant difference ($P \leq 0.05$) among means according to Bonferroni multiple comparison test.

level for both bread and chips was higher than 3.00, with responses ranging from 3.15 to 4.00.

Cassava

Consumption—Of the 130 participants in the survey, 62% of respondents had eaten cassava within the last three months (Table 6). 72.7% females and 50% males had eaten cassava, while Asians, Filipinos, and Micronesians consumed more cassava than the average population did (Table 6). The survey suggested that cassava was not popular among Caucasians. Micronesians were most frequent cassava consumers, followed by Filipinos.

Interest Level—A list of three common food items made from cassava, cake, pudding, and tamales were presented to 130 respondents. Cake received the most interest, while tamales received the least. However, there were no significant differences among the three food items for consumer interest level (Table 7). Asians generated the highest interest level for "pudding", Chamorros for tamales, and Filipinos (3.74) for cake. The age group 45–54 had the highest interest level for the three cassava food items.

"Made in Guam" Products

The overall interest level in "Made in Guam" products on a 1–5 scale was determined from a sample population of 130 respondents (Table 8). In general,

Table 8. Interest level of eating "Made in Guam" products.

Category	Average interest level
Gender:	
Male (64)	4.16
Female (66)	4.42
Age:	
18–24 (36)	3.92
25–34 (37)	4.46
35–44 (34)	4.35
45–54 (23)	4.52
Ethnic Group:	
Chamorro (60)	4.52
Filipino (39)	4.03
Micronesian (11)	4.36
Caucasian (7)	3.86
Asian (6)	4.17
Other (7)	4.29
Total sample population (130)	4.29

Mean rating based on a scale of 1–5, 1=Not Interested, 5=Very Interested. Numbers in parenthesis indicate the number of participants in each category.

older respondents showed their interest in "Made in Guam" products, Chamorros having the highest interest level among the ethnic groups.

Difficulties in Data Collection

In conducting this test, the foremost challenge was getting people to participate. Most people were willing to contribute after a brief explanation of the project objectives by survey administrators, although a few declined to participate. The length and number of questions, and the amount of time required to answer the questionnaire were probably contributing factors to rejection. Some participants indicated that the survey was too lengthy, although questions were designed to be easy to answer. Most participants showed a good understanding with minimal or no extra explanations required and answered most of the questions with little difficulty.

Behavior of respondents differed between locations, and may be a major contributing factor to the number of willing participants. Participation was strictly voluntary and at the Pacific Star Hotel and at Agana Shopping Center, people were more than willing to participate as compared to the people at Bunny Market in Dededo. The people at the northern supermarket were unapproachable and avoided the survey administrators. At the Chamorro Village, surveys were conducted on a Wednesday evening, during which crowds of local people and visitors gather to relax and enjoy free entertainment, eat dinner, buy gifts and souvenirs. Because of the crowds at that time it is generally difficult to walk

around unobstructed and therefore it was very difficult to conduct surveys. Some people commented that they were there to relax and did not want to participate.

Conclusion

Results of the present study demonstrate that there is an interest for value-added products of taro, sweetpotato, and cassava, and in particular sweetpotato chips and sweetpotato bread. Currently, production of sweetpotato chips does not exist on Guam. However, there is small-scale production on Rota, located to the north in CNMI. Sweetpotato accepting emergence of a processed root crop in the Marianas. Although taro, sweetpotato, and cassava have remained traditionally important on Guam, the social and economic changes have outmoded the use of root crop industry in the Marianas. Although taro, sweetpotato, and cassava have remained traditionally important on Guam, the social and economic changes have lessened the demand and the use of the root crops in daily preparation of home cooked meals. The preparation of meals take time and people are looking for convenience, and quick and easy ways to prepare foods. With the rising cost of living and the social demands more families today rely on a two-income salary, which means less time to prepare home-cooked meals. Dining out or picking up prepared meals has also become common practice. It is common to eat while commuting. Drive-through windows, convenience stores selling fast foods, and packaged snack foods have recently become an option to islanders.

Americans are increasing their consumption of eating snack foods (Vollmers et al. 2000). Snack foods are now integrated into work, relaxation and recreation activities. Snack foods and the wholesale bakery industry is a $72 billion industry that includes bakery goods, specialty snacks, confectionery products, and salty snacks. The snack food industry in the United States represents more than $15 billion annually. In terms of exports, about 54% of all food product companies exported snack products in 1996. The Asia/Pacific Rim is the second largest consumer of U.S. snacks next to the United States and Canada (SFA 1998). In addition, health has become a major concern for most people of all ages, and ethnic and economic background. People are seeking not only ease and convenience but also for healthy foods with nutritional value (American Society of Business and Behavioral Sciences Conference 2000). Recent research has shown that the recent trends of the snack food industry include the are production of white corn and blue corn tortilla chips, sweetpotato chips, taro chips, vegetable chips, and trail mixes (SFA 1998).

The development of root crops into ready-to-eat value-added products in Guam will address local demand for convenient and nutritious foods. Microwaveable and ready-to-eat dinners, or snacks such as chips and cookies are examples of value-added foods that might incorporate taro, sweetpotato, and cassava. Results of this concept test demonstrate a market potential for value-added foods made from traditional root crops and a high interest in “Made in Guam” foods.

Recommendations for further studies is to first identify geographic distributions from demographic charts to obtain sample size that approximates characteristics of the population, and to conduct the study over a longer time period. For the population of more than 10,000 a 400 sample size is needed. Less than 400 samples for the size of Guam's population would be considered insufficient to reflect the true characteristics of the population. More than 400 would be not adding any value since there is "a point of diminishing return", and increasing sample size would not make any difference in results (Pecora et al. 1995). Other recommendations would be to conduct surveys in locations that provide high access to the target population. For example, if the target populations are Japanese tourists, then the researcher should conduct surveys in the lobby of a hotel catering to Japanese. If the target population is to be based on age, then the survey administrator must select location sites where many respondents belong to the target age group.

Acknowledgements

Special thanks to the following staff of interviewers, Ruben Dela Cruz, Jay Doronila, Rudy Estoy, Hideko Kasahara, and the students of Dr. Rachel T. Leon Guerrero, CALS/CFS. Special appreciation is also extended to Mr. Gerry Dizon of the Agana Shopping Center, Mr. Ron Kollberg of Bunny Market, and Mr. Jake Barnes of the Chamorro Village. The authors thank all respondents and reviewers of this report and Dr. Randall L. Workman, CALS/CFS, for his extended advise.

This project was supported by USDA-CSREES, Tropical and Subtropical Agriculture Research Grant No. 00-34135-9666 Market Study of Root Crops.

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