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Research in Action 4

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AVRDC – The World Vegetable Center
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AVRDC – The World Vegetable Center is an international nonprofit research institute committed to alleviating poverty and malnutrition in the developing world through the increased production and consumption of nutritious, health-promoting vegetables.

About *Research in Action*

The *Research in Action* series disseminates the practical applications of the Center's work in vegetable breeding, production, marketing, and nutrition. The series aims to encourage vegetable-based enterprise through the extension of information, ideas, technologies, and skills.

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Unless otherwise indicated, all photographs were taken by the first author.

Introduction

About 85% of households in the Solomon Islands are located in rural areas where subsistence agriculture is the main source of livelihood (Jansen et al. 2006). Vegetable production is an integral part of livelihoods in Solomon Islands. In Malaita and Guadalcanal, more than 90% of households engage in vegetable production, either for marketing or home consumption. On average, for those households that produce vegetables, vegetables contribute to more than 50% of total household income. Vegetable production is a significant source of income, although vegetable crops make up only approximately one-quarter of the total crop area (Siliota et al. 2009). The latest available unofficial FAO figures estimate the national total production of fresh vegetables was 6400 metric tonnes in the year 2007 (FAOSTAT 2010).

AVRDC – The World Vegetable Center is implementing a collaborative project on "Integrated Crop Management Package for Sustainable Smallholder Gardens in Solomon Islands" with several local partners, funded by the Australian Centre for International Agricultural Research (ACIAR). The major objective of the project is to increase the economic status and potential income generation opportunities for Solomon Islanders by developing and promoting integrated and improved crop management packages for smallholder vegetable gardens. The project aims to increase vegetable production by introducing a range of new technologies, such as more suitably adapted varieties. To assess the appropriateness of introduced varieties to the local conditions, both production and market dimensions need to be investigated. Therefore, a specific project objective is to assess the market potential for new vegetable species and varieties, and the potential market distortions from increased vegetable production and supply to formal markets of the Solomon Islands. This study addresses the market aspect by assessing the current supply and demand for fresh vegetables in the main markets at Guadalcanal and Malaita and evaluates the market potential of new vegetable varieties.

Methodology and Practical Challenges

The study was conducted in two major markets in two provinces: Honiara Central Market in Guadalcanal Province and Auki Market in Malaita Province (Figure 1), from mid-November to mid-December 2009 which is the end of the dry season. The data for this study was collected (1) through a survey among market vendors based on structured questionnaires and (2) through qualitative interviews with key informants from restaurant and hotel kitchens.

a) b)

Figure 1. Market sites: a) Honiara Central Market, Guadalcanal, b) Auki Market, Malaita

Market Survey

The market survey served two purposes: (1) to determine the trading practices and total volume of vegetables in the markets; and (2) to identify major vegetable varieties and traits that market vendors prefer. The data collected include demographic characteristics of the respondent, trading practices, quantities brought/purchased and sold, selling price, customer characteristics, awareness of new vegetable varieties and species, and interest in new vegetable traits. The traders were asked to characterize their main buyers in the market by identifying the gender and customer type(s). The types suggested were: locals in the area, locals from out of town, expatriates, hotel owners, restaurant owners, store owners, other sellers to trade somewhere else, and others. Traders were asked to rank the different customer types according to their importance (Rank 1 to Rank 6). Respondent were also asked to identify their three most important vegetables and to rate them based on their level of satisfaction for selected production and quality traits. The definition of vegetable traits relates to both production (total yield; days to flowering; maturity; ease of management; ease of seed production/availability of seeds/planting materials); and quality (overall appearance, color, shape, size, texture, taste, storability, freshness, and origin). The rating was based on a five-point Likert scale from 1 (totally not satisfied) to 5 (very satisfied). Finally, the market vendors were shown photographs of the different varieties of major vegetables, and were asked to identify their preferred varieties based on overall appearance. Photographs of the vegetable varieties used were collected from Known-You Seed Company and other online sources (Annex 3).[1]

Most vendors were not familiar with English, and were often suspicious of people asking them questions about their business. Therefore, the assistance of local enumerators who had a rapport with farmers and were able to communicate the information required for the survey was critical for the survey's success. This assistance was sourced from the Ministry of Agriculture and Livestock (MAL) staff in Auki and students from a local technical college in Honiara. Table 1 lists the members of the survey team organized to undertake this study. The enumerators met on the first day at each site to discuss the survey questionnaire and receive training in its use. A pretest was conducted the following day. Refinements on the questionnaire were done afterwards.

Table 1. List of enumerators

Province	Translator/Enumerator	Affiliation
Auki, Malaita	Lionel Maeliu	Independent farmer from Busurata
	Lillian Masmea	Ministry of Agriculture and Livestock
	Robert Tatee	Ministry of Agriculture and Livestock
Honiara, Guadalcanal	Jennifer Billy Godfrey Salo Fox Victoria Inoni Angelyn Huka	Graduates of Learning and Teaching Secondary Home Economics Course, Solomon Islands College of Higher Education

Because the market masters in both locations did not collect data on volume or price, the market vendors were asked for this information. Also, no records of the names and total numbers of vegetable vendors were available in the two market places from which a random sample could have been selected. For this reason, we used the following survey approach. Each vegetable market was divided into sections: 4 in Auki Market and 6 in Honiara Central Market (see Annex 1 for a map of the markets including the sections). The team conducted

[1] Annex 3 is only included in the electronic version of this report, which will be provided upon request.

interviews for one day in each section, and interviewed all vegetable vendors present in that section on that day. If the vendors in one section were too many to interview all in one day, the team came back the following day to finish the interviews in that section. Not all vendors in the different sections sold vegetables but those who offered vegetables were interviewed (visual inspection of the goods being sold was used to identify vegetable vendors).

Table 2 shows the number of vendors interviewed, and the number of all vegetable vendors present in the market for each survey day. Because Saturday is the busiest market day (see results below), the numbers of 257 and 77 are probably close to the maximum number of vegetable vendors ever present in Honiara Central Market and Auki Market, respectively. All vegetable vendors from Auki Market who were approached to participate agreed to be interviewed, and only eight vendors refused to be interviewed in Honiara. Unfortunately, the total number of vegetable vendors could not be obtained for each day in the market, but based on those days that have complete information, 10.4% of all vegetable vendors in Honiara, and 19% of all vegetable vendors in Auki were sampled. The survey team conducted interviews on two Tuesdays, Wednesdays and Saturdays in Honiara. Assuming that about the same total number of vendors comes to the markets on specific week days, the fraction of interviewed persons would be even higher: 26.0%, 21.1%, and 10.1% for Tuesdays, Wednesdays and Saturdays, respectively. It should be noted that the total number of vendors present at the market fluctuates even during the course of one market day, based on our observation.

Table 2. Sample size and sampling fraction per market day

	Vegetable vendors in Honiara			Vegetable vendors in Auki		
Market day	Interviewed	Total	Fraction	Interviewed	Total	Fraction
Monday	x	x		6	34	17.7%
Tuesday	11	-		11	48	22.9%
Wednesday	19	-		16	30	53.3%
Thursday	19	118	16.1%	21	-	
Friday	13	179	7.3%	x	x	
Saturday	15	-		3	77	3.9%
Monday	22	146	15.1%			
Tuesday	29	154	18.8%			
Wednesday	8	128	6.3%			
Thursday	x					
Friday	x					
Saturday	11	257	4.3%			
Average		164	10.4%		47	19.0%

Note: “x” means no interview conducted on that day; “-“ means the number of all vegetable vendors in market that day was not collected.

All quantitative data were analyzed with descriptive statistics using the Statistical Package for the Social Sciences (SPSS) 15. Where obvious differences between the markets occurred, the nonparametric Mann-Whitney test was used to reveal if the differences were significant or not.

Estimation of yearly volumes and values traded

Based on the collected data the mean daily and weekly amount of vegetables traded in the two market places and the corresponding monetary value were estimated. The annual

amount and value of vegetables sold in the two market places were extrapolated for two scenarios using different assumptions. For scenario 1, the survey weeks are assumed to be representative for the whole year. For scenario 2, seasonal differences in the number of customers and vendors on the market were taken into account as follows: Although the humid tropical climate of the Solomon Islands has no pronounced seasonality, the year can be roughly divided into a dry and cool season and a wet and warm season. Based on the long term average rainfall figures compiled by the Solomon Islands Meteorological Service[2] reveal that three months in Honiara (January, February, and March) and four months in Auki (December, January, February, and March) receive more than 250 mm of average rainfall. The threshold of 250 mm was selected assuming that potential flooding is likely to occur above this amount of precipitation, which would disturb vegetable production and transportation. Based on the number of months that receive an average precipitation above the mentioned threshold, the rainy season is assumed to last 17 weeks in Auki and 13 weeks in Honiara.. Due to difficult transportation of goods during the wet season, the number of market vendors was estimated to be only 60% of the number of vendors surveyed during the dry season.[3] Respondents were asked about the typical numbers of customers for the dry and wet season separately. The vendors indicated that their number of clients during the wet season was about 60% of the clients in the dry season.

Restaurant Survey

Parallel with the market study is a restaurant survey that targeted major hotels and restaurants near Honiara to get their points of view on vegetable demand and supply in Solomon Islands. A semi-structured questionnaire was prepared that included an assessment of the type of vegetables normally bought and the varieties, frequency of purchase, and overall contentment with quantity, quality, and diversity of vegetables on offer.

Potential restaurant participants were contacted by telephone. If they were willing to take part, an appointment was made to interview them in their hotel or restaurant. A request letter was then sent to each institution with a confidentiality clause at the end. Several attempts were made to contact those who agreed to participate and who promised to call for an appointment. For those who did not respond, no further arrangement was made due to time constraints.

Practical Challenges

The research team encountered the following practical challenges in the conduct of this study.

Total volume and value of vegetables: The initial plan was to get information about total quantities and corresponding values of the goods sold from the Market Master; however, the officers-in-charge only collect fees from the market vendors. No estimation of the volume or value of vegetable sales has been undertaken so far (McGregor 2006). For this reason, the total volume and value of vegetables were extrapolated based on the daily quantities provided by each vendor interviewed. One has to bear in mind that the extrapolation is based on several assumptions, expert opinions, and data of a very short time period of one week (November 21-26, 2009) in Auki Market, and of two weeks (December 1-12, 2009) in Honiara Central Market. Therefore the results can be seen only as indicative, but probably provide the best approximation available at this point in time.

Conversion of different units of local measure and price estimation: All vegetables in both markets are not sold by weight. Market vendors sell their produce based on local measures, e.g. heaps, bundles, or by piece. These volumes may change during the course

[2] http://www.met.gov.sb/

[3] Grant Vinning, personal communication, July 2010.

of the day depending on rate of produce flow. Most respondents managed to convert these local measures into kilograms during the survey as requested in the questionnaire. When respondents had difficulties with the conversion, a portable scale was used to measure the actual weights of the vendor's produce at the time of the interview. For those vegetables sold during the previous market day but not on the actual interview day and with missing kilogram information, the mean kilogram value per local measure per site was computed and used as a substitute. The same method was done for price estimation.

Logistics and timeframe: Greater flexibility in scheduling the survey activities, a longer survey period, or more enumerators should be arranged for conducting similar surveys in the future. For instance, working with more enumerators would have allowed interviewing all market vendors at the two market sites.

Besides restaurant and hotel kitchen staff, two institutions were also interviewed in Honiara: Rove Prison and the National Referral Hospital. The team aimed to interview more hotels, restaurants and institutions in the capital (See Annex 2 for the institutions contacted); however, confirmation from the General Managers took some time and appointments were rescheduled frequently enough to distort the original plan. It would have been preferable to organize meetings prior to the survey.

Results and Discussion

Demographic Information and Market Characteristics

Characteristics of respondents: A total of 204 respondents in both provinces were interviewed: 57 in Auki Market and 147 in Honiara Central Market (Table 3).

Table 3. Characteristics of respondents by site

Variable		Honiara Central Market		Auki Market		Total	
		N	%	N	%	N	%
Gender	male	17	12	10	17	27	13
	female	130	88	47	83	177	87
	Total	147	100	57	100	204	100
Highest level of education	none	21	14	20	35	41	20
	primary	83	57	31	54	114	56
	secondary or higher	41	28	6	11	47	23
	Total	145	100	57	100	202	100
		Mean	Min-Max	Mean	Min-Max	Mean	Min-Max
Age range (year)		35	15-71	35	14-60	35	14-71
Years in business		8	1 day-42	5	1 day-30	7	1 day-42

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

The study found that 83% and 88% of the market vendors were women in Auki and Honiara markets, respectively. Women look after the management, cultivation (Siliota et al. 2009), semi-processing (bundling, cleaning) and marketing of produce, although men sometimes help bring the produce (hauling) to the market.[4] Most traders in both markets are middle-aged (35 years old), educated to primary level (56%), and have been in the trading business for an average of seven years. The age of respondents ranged from 14 to 71. The number of years in business ranged from one day to 42 years. In Honiara Central Market there are more traders (28%) who reached secondary level of education and have more experience in trading compared with those in Auki Market.

Characteristics of typical customers: About 82% of the respondents in both markets stated that their typical customer is female (Table 4). This was more pronounced in Honiara Central Market, where 85% of the customers were women according to respondents. The figure was much lower in Auki (68%). About 65% of the vendors mainly sold to three customer groups (130 out of 199) (Table 5). It should be noted that the total number of observations per ranking decreased, e.g. Rank 1 had n=199, Rank 2 had n=177 down to Rank 6, which had only n=3. This is because all vendors sell to at least one type of buyer in the market, and fewer vendors sell to more than three customer types.

[4] In this report, the terms “trader” and “market vendor” are used interchangeably. Many of the respondents were farmers and are referred to as such when appropriate (compare Table 6).

Table 4. Customers by gender and site

Gender	Honiara Central Market		Auki Market		Total	
	N	%	N	%	N	%
Male	22	15	12	32	34	18
Female	124	85	26	68	150	82
Total	146	100	38	100	184	100

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=184.

Table 5. Main customer groups identified by traders by site

Rank[3]	Customer group	Honiara Central Market			Auki Market			Total		
		N[1]	Total observations	%[2]	N[1]	Total observations	%[2]	N[1]	Total observations	%[2]
1	Locals in the area	101	146	69	48	53	91	149	199	75
2	Restaurants	51	138	37	3	39	8	54	177	31
2	Locals from out of town	26	138	19	21	39	54	47	177	27
3	Expatriates	56	114	49	7	16	44	63	130	48
4	Hotels	14	46	30	3	12	25	17	58	29

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=199.
[1] Number of observations per ranking is shown in the parenthesis.
[2] The percentages represent the proportion of traders to the total number of observations per ranking.
[3] Only ranks 1 to 4 are represented here, Ranks 5 and 6 are omitted due to low frequencies (less than 5% of the vendors identified a fifth and/or a sixth buyer).

Analysis was done per rank, and hence percentages should not be taken as a whole but by rank. For instance, according to 199 vendors, the customer type locals in the area made up 75% of Rank 1, followed by restaurants (11%), and other sellers (to trade somewhere else)(6.5%). Among the customer types that were enumerated by 177 vendors as the second most important customer (Rank 2), restaurants and locals from out of town had the most shares with 31% and 27%, respectively. Only 130 vendors said they sell to a third type of customer (Rank 3). For those types that were ranked as the third most important customers, expatriates got the highest share (48%). As tourism and business are less developed in Malaita, restaurants and hotels were not important customer groups in Auki Market.

Trading practice: The two markets surveyed are different in nature. Auki Market in Malaita is largely a farmer's market. All produce is supplied from farmers in Malaita only. For this reason, the majority of vendors were the farmers themselves, and only 4% bought vegetables from other farmers to retail (Table 6).

Table 6. Trading practices by site

Variable		Honiara Central Market		Auki Market		Total	
		N	%	N	%	N	%
Do you sell your own produce?	no	43	29	0	0	43	21
	yes	104	71	57	100	161	79
	Total	147	100	57	100	204	100
Do you buy vegetables from others and sell them in the market?	no	104	71	55	96	159	78
	yes	43	29	2	4	45	22
	Total	147	100	57	100	204	100

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

Honiara Central Market is the main market of the country, located in the capital where the highest disposable income is found (compare SISO 2006, p. 40) and supplies produce to more than 60,000 residents (Bamman 2007). Produce from other provinces is traded in this market, including Malaita, Central, and sometimes Isabel and Makira. As the nature of business is different, there tend to be more vendors who act as middlemen and who purchase produce from farmers either at the farm or at the market. Hence, the results showed most traders interviewed were farmers (71%), and a total of 29% of the vendors buy produce from others.

Traders go to the market for retailing 3 to 4 days on average per week in both locations. The frequency of visit ranged from one to six days. Saturday is the busiest market day as most traders (70% to 74%) visit the market to retail. The major market days in Honiara are Monday, Tuesday, Friday, and Saturday; in Auki, it is Tuesday, Friday. and Saturday (Table 7). Overall, Saturday is the day that attracts the largest number of vendors, as the description of our sample in Table 2 shows.

Table 7. Numbers of vendors present at the market by market day and site

Market day	Honiara Central Market		Auki Market	
	N	%	N	%
Monday	85	58	12	21
Tuesday[1]	88	60	28	49
Wednesday	73	50	18	32
Thursday	68	46	20	35
Friday	103	70	24	42
Saturday[1]	103	70	42	74

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
[1] days when vessels operate between Auki and Honiara, see below

Mode of transport: Transportation cost is the largest expenditure for vegetable farmers (Siliota et al. 2009). Pickup truck (64%) was the main form of transportation used by traders in both provinces, especially for long-distance shipments (Table 8).

Table 8. Mode of transportation and related details by site

	N %	Cost (SBD/trip)		Distance (km)		Time spent (hr)	
		Mean	Min-Max	Mean	Min-Max	Mean	Min-Max
Honiara Central Market							
on foot	23	0	0	0.001	0-0.01	.	.
own truck	1	75	50-100	120	120	0.4	0.4
small boat/ship	3	166	50-500	305	100-500	3.0	3.0
rented taxi	3	32	30-40	40	9-90	0.3	0.3
bus	15	4	2-15	29	0.01-275	0.2	0.2
pickup truck	54	90	15-400	118	8-750	1.7	0.7-3
Auki Market							
on foot	7	0	0	2	1-3	.	.
bus	2	2	2	6	6	.	.
pickup truck	91	17	4-80	11	2-8	1	1
Total							
on foot	19	0	0	0.2	0-3	.	.
own truck	1	75	50-100	120	120	0.4	0.4
small boat/ship	2	166	50-100	305	100-500	3	3
rented taxi	2	32	30-40	40	9-90	0.3	0.3
bus	11	4	2-15	28	0.01-275	0.2	0.2
pickup truck	64	61	4-400	72	2-750	1.6	0.7-3

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204. SBD = Solomon Islands Dollar.

Bus and rented taxi were used for shorter distances. In Honiara Central Market, traders who use public transport (pickup truck) traveled, on average, 118 km to the market and spent SBD 90 per trip. Four traders in the sample came by small boat and traveled an average distance of 305 km and/or 3 hours to reach Honiara Central Market.[5] One trader came by "outboard motor," paying a hefty sum of SBD 500 per trip for 100 km. The distance between farm and market was smaller for most traders selling at Auki Market, approximately 11.4 km. In general, a better road infrastructure around Honiara makes transportation easier than in the case of Auki.

In addition to these findings, it is interesting to note that, there are currently six vessels that have regular shipping operations from Auki to Honiara every Tuesday and Saturday (pers. comm. with Mr. Lionel Mailiu from Malaita, November 19, 2009). These are Renbel, Bikoi, LC Dragon, Sa'alia, Haurosi, and MV Solomon Express. MV Solomon Express has a shorter travel time of approximately three hours per trip and costs SBD 200 one way. The remaining five vessels cost SBD 100 per trip. There is no limit to the volume of passenger cargo.

Units of measure: Vegetables were sold in different units of measure (Figure 2). Small size fruit-type vegetables such as small tomato, sweet pepper, and eggplant were sold in heaps. Larger fruit-type vegetables such as pumpkins, cucumbers, and large tomato were sold by piece. Leafy vegetable types, shallots and beans were sold in bundles.

[5] When respondents had difficulties indicating the distance in km, the travel time in hours was recorded instead.

Bundles of shallot; heaps of tomato, eggplant and sweet pepper; cucumber in Auki Market

Cucumber sold by the piece in Honiara Central Market

Figure 2. Vegetables on offer

The mean actual weights are presented in Table 9. Except for eggplant and pumpkin the weight of selling units were higher in Auki Market compared with Honiara Central Market.

Diversity of vegetables: A total of 29 different vegetables were identified in both markets during the survey, 27 in Honiara Central Market and 16 in Auki Market. The higher diversity of vegetables sold in Honiara compared with Auki could be due to the presence of more opportunities for growing vegetables, such as access to wider variety of seeds and a more distinct dry season.

Each trader sold an average of 3.5 types of vegetables in Honiara and 3.2 types of vegetables in Auki with a range from 1 to 7 in both places. The Mann-Whitney test showed that the difference in diversity is significant (Z=-2.307, P=.021). Based on the proportion of vendors selling the crop, the main vegetables traded in the markets during the survey period were tomato, sweet pepper, slippery cabbage (*slippery kabis*), yard-long bean, cucumber, shallot, pumpkin, eggplant, Chinese cabbage, and pak choi (Table 10). Tomato was the most commonly traded vegetable in both markets, sold by 37% of the vendors.

Table 9. Different units used in retailing of the 10 major vegetables by site

Crop	Local Unit	Mean actual weight (kg)	
		Honiara Central Market	Auki Market
tomato	heap	0.38	0.45
sweet pepper	heap	0.32	0.35
slippery kabis	bundle	0.69	0.89
yard-long bean	bundle	0.67	0.71
cucumber	piece/fruit	0.45	0.49
shallot	bundle	0.26	0.30
pumpkin	piece/fruit	1.89	1.20
eggplant	heap	0.83	0.68
Chinese cabbage	bundle	1.03	1.13
pak choi	bundle	0.64	-

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=406 observations.

As this survey was conducted toward the end of the dry season with more favorable cropping conditions as compared with the wet season, the diversity observed in the market should be on the high side compared with the rainy season.

Volume and value of major fresh vegetables traded: The volumes of vegetables traded per day during the survey period are presented in the following tables. The mean traded volume per vegetable crop in Honiara Central Market was about twice the volume traded in Auki Market (Table 12). The mean quantity sold per vendor per day for each kind of vegetable was larger in Honiara Central Market, except for sweet pepper (Table 11). Among the crops, *slippery kabis* was the most important vegetable in terms of volume traded. The average volume traded per vendor per day for *slippery kabis* was 62 kg, reaching 228 kg in Honiara Central Market (Table 11). For the 53 vendors selling this crop, total volume traded per day averaged 520 kg, even reaching up to 1,115 kg per day (Table 12). This indicates the importance of *slippery kabis*.

Although tomato was sold by the largest share of vendors (37%), the volume of tomato sold averaged 12 kg per trader (Table 11). The total quantity sold per day was 72 kg (Table 12). Sweet pepper ranked second in terms of the number of vendors number selling the crop. Among the 61 vendors (30%) who sold sweet pepper, the average quantity traded was only 13 kg (Table 11). The total quantity sold per day was 61 kg (Table 12). Despite the popularity of these two crops, production constraints may have limited the yield, which resulted in the low supply.

During the survey, it was observed that heap sizes and prices of tomato and sweet pepper may fluctuate during a day, particularly during the peak selling time, and may affect the selling price. A likely scenario could be that the vendors wish to leave the market by noon and therefore drop the price. The middlemen step in and purchase the remaining produce and reset (increase) the price for the rest of the day. For slippery cabbage, we did not observe such price fluctuation. However, resources of this study did not allow verifying this observation empirically. It would require recording the selling prices and unit sizes for selected vendors over the time period of one market day. Hence the daily price fluctuations remain an interesting research topic for the future.

It should be noted that the demand and supply condition in Auki Market varies greatly when ships arrive from Honiara and vice versa. As the vegetable price is lower in Auki, the middlemen would purchase the produce to take to Honiara. This results in high demand of vegetables and there is rarely any leftover at the end of the day.
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Table 10. Number of market vendors selling the specific vegetable crops by site

Crop	Honiara Central Market		Auki Market		Total	
	N	% [a]	N	% [a]	N	% [a]
tomato	50	34	25	44	75	37
sweet pepper	49	33	12	21	61	30
slippery kabis	31	21	22	39	53	26
yard-long bean	40	27	11	19	51	25
Chinese cabbage	23	16	21	37	44	22
cucumber	32	22	8	14	40	20
shallot	30	20	10	18	40	20
pumpkin	34	23	2	4	36	18
eggplant	19	13	13	23	32	16
pak choi	23	16	0	0	23	11
choy sum	17	12	1	2	18	9
snake gourd	13	9	3	5	16	8
hot pepper	12	8	0	0	12	6
watercress	7	5	3	5	10	5
kangkong	9	6	0	0	9	4
fern (*kasume*)	7	5	1	2	8	4
taro leaf	6	4	0	0	6	3
leafy pumpkin	4	3	0	0	4	2
bitter gourd	4	3	0	0	4	2
lettuce	3	2	0	0	3	1
dwarf bean	3	2	0	0	3	1
ball cabbage	1	0.7	1	2	2	1
apple cucumber	2	1	0	0	2	1
winged bean	1	0.7	0	0	1	5
Chinese kale	1	0.7	0	0	1	0.5
winter melon	1	0.7	0	0	1	0.5
garlic leaves	1	0.7	0	0	1	0.5
cherry tomato	0	0	1	2	1	0.5
other	0	0	1	2	1	0.5
Total respondents	147		57		204	

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=558 observations.
[a] % of responses to total respondents.

Table 11. Average quantity (kg) sold per trader per day of each vegetable crop by site

Crop	Honiara Central Market			Auki Market			Total		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
slippery kabis	87.3	20	228	20.1	6	50	62	6	228
cucumber	53.6	1	160	18.5	3	75	44	1	160
pumpkin	45.5	4	120	1.0	1	1	42	1	120
winter melon	40.0	40	40	.	.	.	40	40	40
Chinese cabbage	52.7	5	220	20.3	4	113	38	4	220
lettuce	23.8	24	24	.	.	.	24	24	24
fern (*kasume*)	23.6	10	46	.	.	.	24	10	46
leafy pumpkin	23.6	11	40	.	.	.	24	11	40
bitter gourd	23.0	23	23	.	.	.	23	23	23
yard-long bean	23	2	200	10.2	2	35	20	2	200
eggplant	26.7	2	75	10.1	1	68	19	1	75
pak choi	17	3	55	.	.	.	17	3	55
ball cabbage	23.5	24	24	7.5	8	8	16	8	24
Chinese kale	15	15	15	.	.	.	15	15	15
shallot	16	2	55	5.7	2	15	13	2	55
snake gourd	13	8	30	.	.	.	13	8	30
sweet pepper	11	1	35	18.3	2	123	13	1	123
tomato	13	1	56	8.7	1	25	12	1	56
choy sum	11	2	23	2.0	2	2	10	2	23
dwarf bean	10	10	10	.	.	.	10	10	10
hot pepper	10	0	27	.	.	.	10	0	27
apple cucumber	9	9	9	.	.	.	9	9	9
watercress	9	3	16	4.5	4	5	7	3	16
taro leaf	7	4	10	.	.	.	7	4	10
kangkong	5	3	8	.	.	.	5	3	8
winged bean	2	2	2	.	.	.	2	2	2
cherry tomato	.	.	.	0.4	0.4	0.4	0.4	0.4	0.4
Mean	28	0	228	13	0	123	24	0	228

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=390 observations.

Table 12. Total quantity (kg) sold per day of each vegetable crop by site

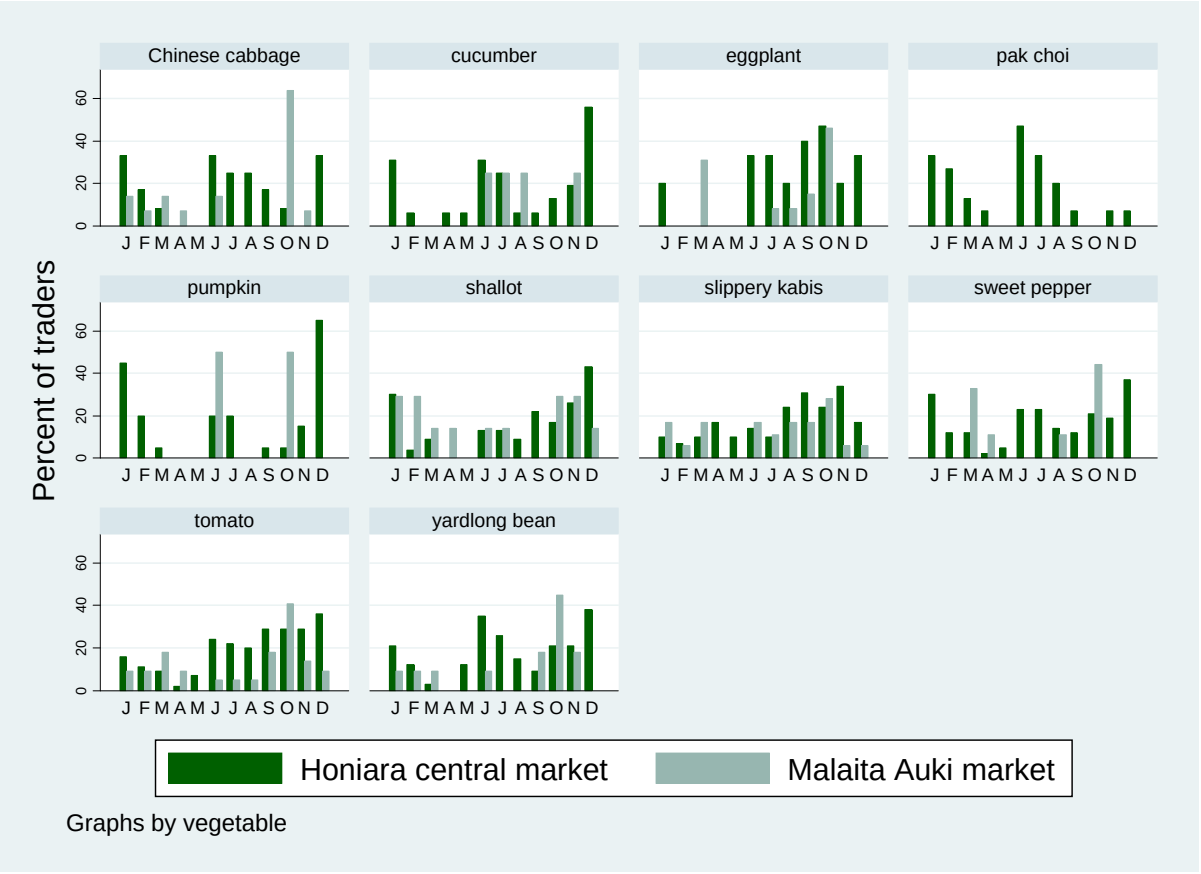
Crop	Honiara Central Market			Auki Market			Total		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
slippery kabis	748	41	1115	198	6	271	519	6	1115
Chinese cabbage	170	5	365	81	18	173	129	5	365
cucumber	144	9	278	62	3	85	129	3	278
yard-long bean	129	12	301	24	6	42	107	6	301
pumpkin	106	45	145	1	1	1	100	1	145
pak choi	77	15	147	.	.	.	77	15	147
tomato	80	21	134	56	4	82	72	4	134
eggplant	73	10	127	56	6	98	66	6	127
sweet pepper	61	5	126	59	22	129	61	5	129
lettuce	48	48	48	.	.	.	48	48	48
shallot	45	3	109	28	2	34	41	2	109
winter melon	40	40	40	.	.	.	40	40	40
fern (*kasume*)	25	10	46	.	.	.	25	10	46
snake gourd	25	16	38	.	.	.	25	16	38
leafy pumpkin	24	11	40	.	.	.	24	11	40
bitter gourd	23	23	23	.	.	.	23	23	23
taro leaf	20	20	20	.	.	.	20	20	20
ball cabbage	24	24	24	8	8	8	16	8	24
watercress	21	10	25	5	4	5	16	4	25
choy sum	16	8	23	2	2	2	15	2	23
Chinese kale	15	15	15	.	.	.	15	15	15
hot pepper	10	5	27	.	.	.	10	5	27
dwarf bean	10	10	10	.	.	.	10	10	10
kangkong	9	8	10	.	.	.	9	8	10
apple cucumber	9	9	9	.	.	.	9	9	9
winged bean	2	2	2	.	.	.	2	2	2
cherry tomato	.	.	.	0.4	0.4	0.4	0.4	0.4	0.4
Mean	130	2	1115	77	0	271	117	0	1115

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=390 observations.

Trends in difficulty or ease of selling vegetables: Traders in Honiara Central Market believe it is more difficult to sell the major vegetables, except pumpkin and shallot, during the dry season (May to November), which could be due to an abundance of produce in the market (Figure 3). Pumpkin could be stored for a longer period. Thus the difficulty in selling pumpkin may not relate directly to seasonality of the supply. Most of the major vegetables are difficult to sell, especially in December, except for pak choi and *slippery kabis* at Honiara.

In Auki Market, traders have a different experience; October is the month that most traders experienced difficulty in selling the main vegetables. The problem also occurred from June to August and November for cucumber, and in June for pumpkin. A few crops were difficult

to sell during the rainy season, such as shallot in January to February, and eggplant and sweet pepper in March.

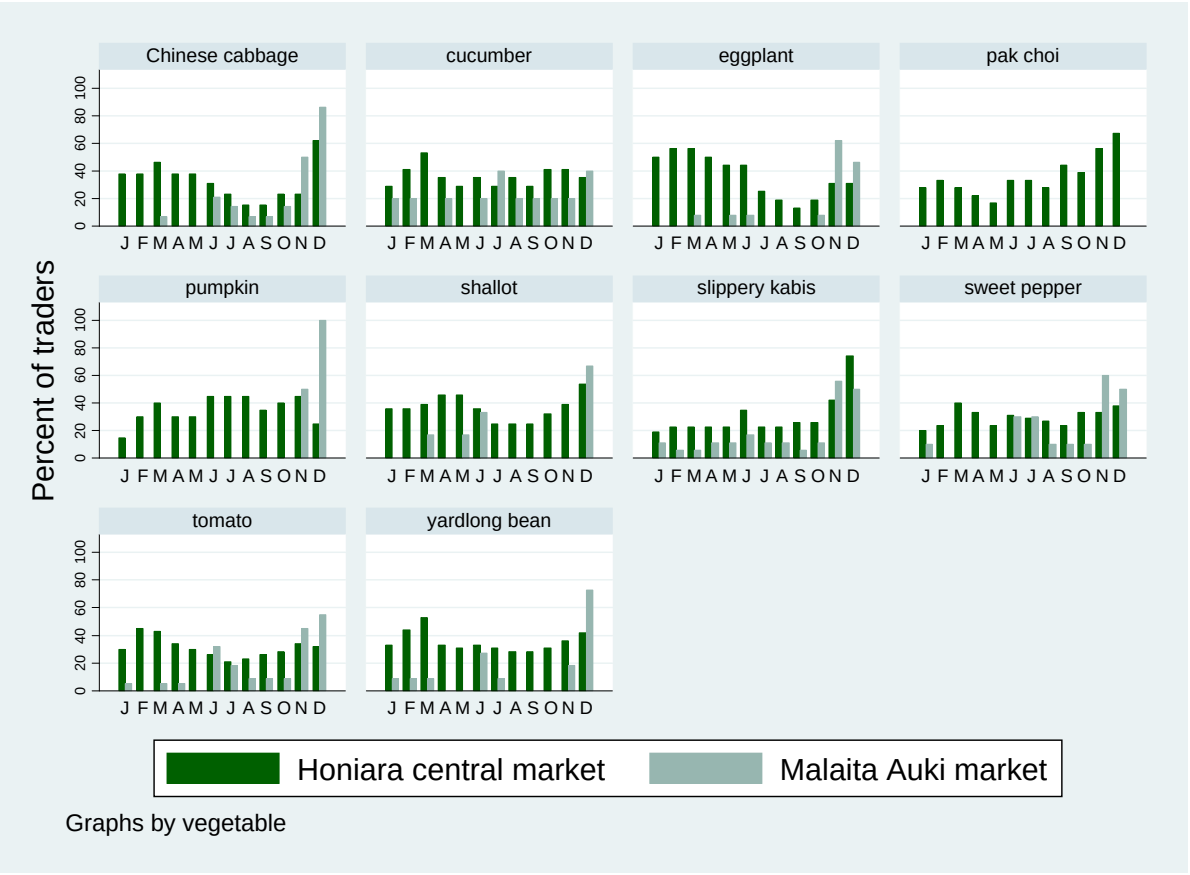


Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
Note: % of responses to total N; pak choi data of Auki Market not available, as no vendor was selling the crop.

Figure 3. Traders' perception of the months that vegetables are difficult to sell due to oversupply

In Honiara Central Market, vegetables like Chinese cabbage, cucumber, eggplant, shallot, sweet pepper, tomato and yard-long bean can be sold easily in the first half of the year, especially from February to April (Figure 4). This is the rainy season, when the supply of these vegetables is lower due to plant growth habits and transport constraints. From September to December, pak choi is easier to sell in the market and *slippery kabis* is easiest to sell in December. It is known that the demand of these two crops is particularly high around Christmas. In the case of pumpkin traders feel that, except in January and December, the supply is not sufficient throughout the year. These observations are in agreement with the perception of the difficulty to sell (Figure 3). In Auki, main vegetables can be sold easily in November and/or December, and July is also a month when cucumber can be sold easily. Produce is difficult to sell in October because this is the most abundant month, particularly for fruit-type crops. During November and December, people are preparing for holidays and demand for produce increases.

The information on traders' perceptions of trends on the difficulty or ease of selling certain vegetables should serve as a guideline to modify production timing. For example, supply of fruit-type vegetables from February to April for Honiara Central Market could be increased if farmers could sow or transplant the crop from November to January.



Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
Note: % of responses to total N; pak choi data of Auki Market not available, as no vendor was selling the crop.

Figure 4. Traders' perception of the months that vegetables are easy to sell due to insufficient supply

Volumes and values of vegetables traded

Table 13 shows the aggregated volume and value of vegetables sold on average on a daily basis by each trader. The average volume sold per trader in Honiara Central Market is approximately double the volume sold in the Auki Market, 54 kg per trader versus 25 kg per trader. Average revenues were calculated based on actual prices multiplied by quantities sold and by dividing by the number of respondents. In Honiara, the mean revenue per market day for a vendor is SBD 493 while it is only SBD 139 in Auki. It is interesting to note that the average price per kg (this is aggregated revenue from all vegetables sold divided by aggregated volume of all vegetables sold) is nearly double in Honiara compared with Auki. As production cost can be considered to be similar in both locations, the difference in price may partly be attributed to higher transport cost for traders in Honiara, but may also reflect the larger consumer demand in that market compared with Auki.

Table 13. Average vegetable volume traded and revenue per day and trader, November 2009 (end of dry season)

	Honiara Central Market	Auki Market	Average
Volume of vegetables sold (kg)	54.3	25.4	46.2
Revenue (SBD)	493.2	138.8	394.1
Average price per kg	9.08	5.45	8.53

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

Based on average volume and revenue from Table 13 and the total average number of traders in the market per day (Table 2), we estimate total sales and turnover for vegetables on a weekly basis. The estimated total volume of traded vegetables in one week in Honiara is approximately 53 metric tons valued at about SBD 485,000 and 7.2 metric tons of vegetables valued at about SBD 39,000 in Auki Market (Table 14).

Table 14. Estimated weekly volume and value of vegetables traded by site, dry season

	Honiara Central Market	Auki Market
Estimated total volume sold (kg)	53,452	7,172
Estimated total value sold (SBD)	485,275	39,135

Note: weekly volume and value was estimated based on average values per trader on a daily basis, multiplied by the total average number of traders in the market per day, multiplied by 6 market days.
Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

Yearly scenario 1: If the three survey weeks were representative of a typical market week within a year, it could be estimated that total annual vegetable sales per year are somewhere around 2,800 metric tonnes in Honiara Central Market worth some SBD 25 million; and around 400 MT worth some SBD 2 million in Auki Market.

Yearly scenario 2: Taking into account seasonal differences mentioned earlier, the following volumes and values for a wet season week were calculated (Table 15). Accordingly the traded volume of vegetables would reduce to 19 metric tonnes per week in Honiara and to 2.7 metric tonnes in Auki. The values of vegetable sales would be about SBD 174,000 at Honiara Central market and about SBD 15,000 at Auki Market.

Table 15. Estimated weekly volume and value of vegetables traded by site, wet season

	Honiara Central Market	Auki Market
Assumption on reduction of number of customers[1]	0.5981	0.6358
Assumption on reduction of number of vendors[2]	0.6	0.6
Estimated total volume sold (kg)	19,180	2,731
Estimated total value sold (SBD)	174,134	14,900

Note: [1] according to survey results, [2] according to expert estimation (Vinning, personal communication, 07/2010)
Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

Assuming that the dry season lasts 39 weeks and the wet season 13 weeks, the total volume sold per year would be 2,334 metric tonnes at a value of about SBD 21 million at Honiara Central Market. The total volume of vegetables sold at Auki Market would be 297 metric tonnes at a value of about SBD 1.6 million assuming a dry and wet season of 35 vs. 17 weeks.

These trends in difficulty and ease of selling vegetables as well as price variations over the year could also help to calculate more accurate yearly figures for volume and values. However, it is probably better to base further estimations on a broader data base collected at different times during the year than to go into more detailed assumptions about variations over time.

Potential for New Varieties

This project aims to increase the crop diversity of the Solomon Islands by introducing new varieties of selected vegetables that can be adapted to the local environment. Before a variety can be recommended, it should be evaluated under existing cropping systems and for its market potential. Here we evaluate the market potential by understanding traders' perception on their satisfaction of important vegetables, awareness of new varieties, and preference of new varieties with good market potential.

Satisfaction matrices for selected production and quality traits: The respondents were asked to enumerate their most important (top three) vegetables that they sell in the market. In total, all the respondents provided a total of 25 vegetables. The vegetables were classified into various types: bean, bulb, fruit, gourd, heading, and leafy, and were analyzed accordingly.

Production trait related responses are summarized in Table 16. Farmers were more than satisfied (> 4) with the yield, maturity, and ease of seed production / availability of planting materials of most of their important vegetable crops, except for lettuce (yield), winter melon (maturity), ball cabbage, Chinese cabbage, watercress and taro leaf (ease of management), whose mean ratings fall between 3 and 4. In terms of ease of management, farmers were not satisfied with the management of dwarf bean, ball cabbage, choy sum and watercress, and the mean rating was lower than 3 (2.0 to 2.8).

Quality trait related responses are summarized in Table 17. The quality traits of vegetables include appearance, edibility, and postharvest traits. Vegetable appearance traits include overall appearance, color, shape, size, and freshness. Edibility quality pertains to texture and taste. Postharvest, in this case, only refers to storability. The origin of vegetable was included because consumers may have had location-specific bias on where the vegetables are cultivated. For example, farms using organic practices may be preferred to those using pesticides. Overall, market vendors are satisfied and/or very satisfied with the selected quality traits of major vegetables they sell. Mean ratings for bean-type, bulb-type, fruit-type, and gourd-type vegetables are high, ranging from 4.1 to 5.0 for all quality traits. For heading types, market vendors are somewhat indifferent to the origin of the produce, with a mean rating of 3.6. Similarly, market vendors are indifferent with regard to taste (3.0) for bitter gourd and leafy pumpkin, texture of watercress (3.3), storability of bitter gourd (3.0), fern or *kasume* (3.3) and watercress (3.3).

Missing vegetables with good market potential: Awareness of vegetable varieties with good market potential that traders are not currently selling in the market was also assessed to gauge potential demand. More than one-third of the respondents in both markets miss vegetables with good market potential at some point in time (Table 18). The reasons vary from production constraints (infertile soil, high incidence of insects, pests and diseases, excessive rain), lack of financial resources (high cost of production, high transportation cost, expensive seeds), no/poor access to resources (seeds, land, water), to seasonal availability (not available in the market when they want to sell it, insufficient quantities from farmers). However, traders identified Chinese cabbage (35% of respondents), sweet pepper (30% of respondents) in Honiara and ball cabbage (60% of respondents) and Chinese cabbage (35% of respondents) in Auki as the major marketable vegetables that they currently do not sell that have good market potential.

Table 16. Production trait satisfaction matrix by vegetable sold in both markets

Vegetable	N	Total yield	Maturity	Ease of management	Ease of seed production/ availability of planting materials
Bean					
yard-long bean	33	4.6	4.7	3.2	4.2
dwarf bean	1	4.0	5.0	2.0	4.0
Bulb					
shallot	26	4.7	4.5	4.0	4.3
Fruit					
tomato	44	4.5	4.6	3.7	4.1
eggplant	23	4.7	4.7	3.8	4.1
hot pepper	2	5.0	5.0	4.0	4.5
Gourd					
pumpkin	15	4.9	4.4	3.4	4.2
cucumber	12	4.9	4.9	3.4	4.2
snake gourd	5	5.0	4.6	3.8	4.0
winter melon	1	5.0	3.0	4.0	4.0
apple cucumber	1	5.0	5.0	4.0	5.0
bitter gourd	1	5.0	5.0	4.0	5.0
Heading					
ball cabbage	3	4.3	4.0	2.7	3.3
Chinese cabbage	45	4.7	4.4	3.2	3.8
Leafy					
slippery kabis	32	4.7	4.4	4.0	4.2
pak choi	17	4.5	4.6	3.4	4.2
choy sum	8	4.6	4.6	2.8	4.0
fern (*kasume*)	4	5.0	5.0	5.0	5.0
kangkong	3	4.7	5.0	3.3	4.0
lettuce	3	3.7	4.3	4.3	4.0
watercress	2	4.0	4.5	2.5	3.5
taro leaf	2	4.5	5.0	4.5	3.5

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=322 observations.
Note: Crops are arranged chronologically in order of importance. Based on scale of 1=totally not satisfied, 2=not satisfied, 3=don't know, 4=satisfied, 5=very satisfied.

Table 17. Quality trait satisfaction matrix by vegetable sold in both markets

Vegetable	N	Overall appearance	Color	Shape	Size	Texture	Taste	Storability	Freshness	Origin
Bean										
yard-long bean	36	4.5	4.4	4.2	4.2	4.1	4.6	4.3	4.4	5.0
dwarf bean	1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Bulb (shallot)										
shallot	39	4.7	4.7	4.6	4.4	4.4	4.7	4.1	4.5	4.4
Fruit										
sweet pepper	51	4.6	4.6	4.6	4.4	4.4	4.7	4.2	4.5	4.6
hot pepper	5	5.0	4.8	5.0	4.8	4.8	4.6	4.3	4.7	5.0
eggplant	26	4.3	4.3	4.2	4.0	4.0	4.6	4.5	4.4	4.5
tomato	57	4.3	4.3	4.2	4.1	4.0	4.4	3.8	4.3	4.3
Gourd										
cucumber	12	4.4	4.6	4.4	4.5	4.3	4.8	4.5	4.8	5.0
pumpkin	15	4.9	4.9	4.7	4.7	4.7	4.9	4.8	4.9	5.0
snake gourd	5	5.0	4.8	4.6	4.8	4.0	4.6	4.4	5.0	
winter melon	1	4.0	5.0	4.0	5.0	5.0	5.0	4.0		
apple cucumber	1	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
bitter gourd	1	5.0	5.0	5.0	4.0	4.0	3.0	3.0	4.0	
Heading										
ball cabbage	5	3.8	4.0	4.0	4.2	4.2	4.6	3.8	4.6	3.5
Chinese cabbage	48	4.4	4. 5	4.3	4.2	4.3	4.7	4.1	4.1	3.8
Leafy										
choy sum	15	4.6	4.7	4.5	4.4	4.5	4.7	4.0	4.7	4.0
fern (*kasume*)	4	4.8	5.0	4.8	5.0	4.5	5.0	3.3	5.0	
kangkong	4	4.8	5.0	4.3	4.3	5.0	5.0	4.0	4.0	4.0
leafy pumpkin	1	4.0	4.0	4.0	5.0	4.0	3.0	2.0	5.0	4.0
lettuce	3	4.3	5.0	4.7	4.7	4.7	5.0	4.7	4.5	
pak choi	22	4.6	4.7	4.6	4.5	4.5	4.7	4.3	4.6	4.5
slippery kabis	50	4.6	4.8	4.5	4.4	4.2	4.7	4.1	4.5	3.9
taro leaf	2	5.0	5.0	4.5	4.5	5.0	5.0	4.0	4.0	4.0
watercress	3	4.3	4.3	4.0	4.0	3.3	4.7	3.3	4.5	4.0

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=407 observations.
Note: Crops are arranged chronologically in order of importance. Based on scale of 1=totally not satisfied, 2=not satisfied, 3=don't know, 4=satisfied, 5=very satisfied.

Table 18. Vegetables with good market potential that currently are not sold in the market identified by traders by site

	Honiara Central Market		Auki Market		Total	
	N	%	N	%	N	%
Are you missing any important vegetables with good market potential in the market?						
no	91	62	37	65	128	63
yes	56	38	20	35	76	37
Total	147	100	57	100	204	100
Vegetables with good market potential but not being sold						
sweet pepper	17	30	1	5	18	24
ball cabbage	6	11	12	60	18	24
Chinese cabbage	20	35	7	35	27	36
choy sum	10	18	2	10	12	16
cucumber	10	18	0	0	10	13
yard-long bean	7	13	3	15	10	13
shallot	9	16	0	0	9	12
eggplant	3	5	5	25	8	11
slippery kabis	7	13	0	0	7	9
tomato	6	11	0	0	6	8
pak choi	5	9	1	5	6	8
lettuce	2	4	1	5	3	4
pumpkin			2	10	2	3
other	5	9	2	10	7	9
Total	56		20		76	

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
a. % of responses to total N.

Utilization of new varieties: Evaluation of the current status of the traders' utilization of new varieties was done to determine what the important traits are for variety adoption, and to see how consumers respond to these new varieties. Only 19% of the traders in both markets have tried to sell new vegetable varieties, either because the availability of new varieties that traders can purchase is not very prominent, or traders are unaware of new varieties available in the market. In Honiara Central Market, 85% of traders stick to the usual vegetables that they sell, but in Auki Market, 28% have tried selling new varieties (Table 19). The top reasons cited for introducing new varieties are easier to sell (66%); better quality of vegetables in terms of color, shape, size and texture (58%), which is also a reflection of being easier to sell; higher yield (34%), and higher resistance to pests and crops (32%).

There are 12 types of vegetables with new varieties that traders sell. Of these, new varieties of Chinese cabbage, *slippery kabis*, eggplant, and sweet pepper are the common types normally offered by traders. There are differences in the choices of new varieties of vegetables that traders sell between the two markets. For example, traders in Honiara Central Market prefer the broader and whiter varieties of Chinese cabbage while traders in Auki opt for the local and the round varieties (Table 22).

Table 19. Utilization of new varieties by site

	Honiara Central Market		Auki Market		Total	
	N	%	N	%	N	%
Did you try to sell a new variety?						
No	125	85	41	72	166	81
Yes	22	15	16	28	38	19
Total	147	100	57	100	204	100
How was this variety different to the one you previously sold? [a]						
easy to sell	12	55	13	81	25	66
its quality is better in terms of color, shape, size and texture	10	45	12	75	22	58
has higher yield	2	9	11	69	13	34
has higher resistance to pests and diseases	6	27	6	38	12	32
new variety has extended harvest period	5	23	6	38	11	29
can be stored longer	3	14	5	31	8	21
has better price in the market	7	32	1	6	8	21
requires less labor inputs	7	32	0	0	7	18
Other	5	23	2	13	7	18
has less spoilage during transport and handling	3	14	1	6	4	11
can be cultivated during off-season	0	0	1	6	1	3
has better seed germination	0	0	1	6	1	3

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
a. % of responses to total N. Answered by the "yes" group.

Traders believe that vegetable buyers are not very receptive to the new varieties being offered in the two markets. Most of the traders find it difficult to sell the new varieties that buyers are not accustomed to (68%). This is more pronounced in Honiara Central Market, where 77% find it hard to persuade customers to buy the new selection. In Auki, the number of traders who find it difficult to sell the new varieties is almost the same as those who are successful in persuading buyers to choose the new ones (Table 21). Participatory selection of new varieties by the farmers and customers could increase the acceptance of a new variety. Parallel to the buyers' lack of preference for the new varieties, nearly none of the traders had information on AVRDC varieties that farmers grow in their areas. Only 3% of the traders knew of vegetable varieties sourced from AVRDC (Table 22). As only a few varieties introduced by the project have entered the promotion stage, the unfamiliarity of AVRDC varieties is expected.

Better varieties considered by traders: Traders were shown pictures of various types and varieties of vegetables, and asked which of the vegetables they think are better than the ones being sold and which they are interested in trying. Table 23 lists the major vegetable varieties preferred by traders. The main reasons behind their choices include color, size, shape, and texture of the vegetable crop. For example, most traders prefer yard-long bean with green pods (79%), cabbage with dark green leaves (73%), and onion with white bulbs (50%). Traders differ in their preferences for vegetables. Thus, only a few varieties of cabbage, onion, and yard-long bean were selected by majority of traders (≥ 50%). Different preferences were observed between traders in the two markets. For example, hot chili with a

long tapered shape was preferred by 53% of traders in Auki Market, but preferred only by 26% of traders in Honiara Central Market.

Table 20. New varieties used by traders by site

Crop	Honiara Central Market		Auki Market	
	N	Specific trait	N	Specific trait
Bean	2	· short	1	· short
Chinese cabbage	3	· small heads · broader and whiter stem	7	· longer heads · short and round heads · small heads · a local variety · round heads
Cucumber	1	· light green color	0	
Eggplant	1	· light purple color	3	· big · round · thinner
Pak choi	1	· green stem	1	· slightly curled oblong leaves
Pumpkin	3	· curry (for its color) · long	0	
Shallot	2	· big bulb and thick leaves · white stem	0	
Slippery kabis	4	(referring on its leave shape and appearance) · big leaves · "frog cabbage" · noodle hair	1	· long stem
Sweet pepper	3	· big size · long fruit · short fruit	1	· short fruit
Tomato	1	· small red fruits	1	· small and round
Yard-long bean	1	· white seed mixed with yellow, longer	0	

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=37.

Table 21. Receptiveness of customers to the new varieties by site

	Honiara Central Market		Auki Market		Total	
	N	%	N	%	N	%
Did you find it difficult to convince your customers to choose the new variety?						
no	17	77	9	56	26	68
yes	5	23	7	44	12	32
Total	22	100	16	100	38	100

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=38.

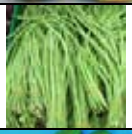
Table 22. Knowledge on AVRDC varieties

	Honiara Central Market		Auki Market		Total	
	N	%	N	%	N	%
Do you know about any AVRDC varieties that the farmers are using in their area?						
no	142	97	56	98	198	97
yes	5	3	1	2	6	3
Total	147	100	57	100	204	100

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.

Table 23. New varieties respondents are interested in (%)

Vegetable	Variety no. [a]	Characteristics	Photo	Honiara Central Market (%)	Auki Market (%)	Total (%) [b]
Cabbage	4	Dark green leaves, large, flat globe head		74	71	73
Chinese cabbage	5	Dark green outer leaves, medium-large, elongated and firm head		42	21	36
	2	Dark green head, medium-large, compact, large in size		32	24	30
	6	Light green outer leaves, elongated firm head, compact		23	24	23
Choy sum	6	Green stalks		36	38	36
	4	White stalks, green leaves		32		23
	2	Dark green leaves, thick stem		21	24	22
	7	Thick, crunchy stalks, yellow flowers and green leaves		23	10	19
Pak choi	7	Semi-erect, smooth leaves have beautiful shape with thick petioles		24	21	23
	1	Smooth leaves with thick petioles		22	21	21
	2	Plant is semi-spreading with snow-white and smooth petioles, leaf is undulate, olive green and wrinkly surface		25	11	21
	6	Erect, slight curled oblong leaves and thick petioles		18	26	20
Tomato	8	Oblate, with light green shoulder		33	48	37
	2	Pink and round		24	9	20

Vegetable	Variety no. [a]	Characteristics	Photo	Honiara Central Market (%)	Auki Market (%)	Total (%) [b]
	1	Globe to deep globe shaped, with dark green shoulder		21	4	16
Bulb onion	5	White inside, its layers of papery skin have a yellow-brown color		44	57	50
	2	Purple-red skin with white flesh tinged with red, medium-large		31	43	37
Bitter gourd	2	Bright-white, blocky		36	20	33
	6	Long-shaped fruit, with light green rind and flesh		32	20	30
	4	Blocky, heavy warted curds on ribbed bright green skin and long		23	20	22
Eggplant	5	Fruit is purple-red, calyx is purple-green, extra slim in shape		42	25	36
	8	Purple-red fruit, purple-green calyx, long		38	33	36
	3	Fruit is purple-red, calyx is purple-green, long and thick in shape		22	21	22
Pumpkin	8	Yellow-brownish rind, orange-yellow flesh, elongated		18	36	24
	9	Mottled orange-yellow, golden-yellow flesh, elongated		10	27	16
	13	Orange-red rind, orange-yellow flesh, oval-shaped		10	23	15
	15	Yellow brown with spots, orange-yellow flesh, oblate		20	5	15
Yard-long bean	2	Long, light-green pods		83	72	79
Cucumber	8	Green, long with rounded ends		29	32	30

Vegetable	Variety no. [a]	Characteristics	Photo	Honiara Central Market (%)	Auki Market (%)	Total (%) [b]
	4	Glossy deep green, straight and chubby		29	20	25
	6	Light green and chubby		22	16	20
	2	Light green, short cylinder in shape		15	20	17
Sweet pepper	5	Bell-shaped, purple when young, red when mature		34	20	30
	3	Bell-shaped, green and yellow fruit		26	36	29
	9	Elongated bell, green when young and red when mature		28	16	24
Hot chili	2	Long-tapered shape, 3.7cm in diameter		26	53	38
	5	Dark green leaves, fruit is uniform, smooth, young fruit is dark green and mature fruit becomes red, 1.5cm in diameter		22	29	25

Source: Survey conducted by AVRDC – The World Vegetable Center in 2009, N=204.
Notes: [a] Numbers referred in this column can be found in Annex 3, which is only published in the e-version of this report; [b] % of responses to total N. Photo credits: All images courtesy of Known-You Seed Company, Taiwan, http://www.knownyou.com.tw/, except for:
yard-long bean, courtesy of Wikipedia http://en.wikipedia.org/wiki/File:Long_Bean.JPG;
yellow onion, courtesy of PDPhoto.org http://www.pdphoto.org/PictureDetail.php?mat=pdef&pg=8445

Perceptions of Restaurants on Vegetable Supply

One representative each of a total of four restaurants was interviewed: Jina's Restaurant, King Solomon Hotel, Pacific Casino Hotel, and Honiara Hotel in Honiara (Table 24). The interviewees were either purchasing officers or kitchen staff. Many had difficulty providing the exact volume of vegetables that they bought. The common types of vegetables bought include pak choi (all 4 respondents) and Chinese cabbage (3 respondents). In general, they are content with the quantity and quality, but not with the diversity. Direct purchasing from specific farmers or vendors for specific kinds of vegetables was observed. Farmers could target these special customers for contract production arrangements in the future.

Table 24. Purchasing habits and perception on vegetable supplies of selected restaurants in Honiara

Questions	Jina's Restaurant	King Solomon Hotel	Pacific Casino Hotel	Honiara Hotel
What are the vegetables that you normally buy? (list in alphabetic order)	Choy sum, eggplant, lettuce, pak choi, shallot, sweet pepper, yard-long bean	Chinese cabbage, choy sum, cucumber, pak choi, tomato	ball cabbage, beans, bitter gourd, Chinese cabbage, carrot, cucumber, endive, lettuce, okra, pak choi, sweet pepper, tomato	ball cabbage, Chinese cabbage, cucumber, eggplant, lettuce, pak choi, snap bean, yard-long bean
Do varieties in the market change greatly over the year?	no	Yes, depending on the season	no	yes
How frequent do you buy vegetables?	Daily	Three times a week (Mon., Wed. and Fri.)	daily	daily
From where and whom do you normally buy vegetables?	Central Market; no specific vendors	Central Market, Kastom Gaden, and a group of farmers in Benskree and Rovatu	No specific vendors	Central Market; no specific vendor except for sweet pepper (only from one vendor)
Are you content with the quantity of vegetables that you can buy over the year?	Yes	Yes	No	No
Are you content with the quality of vegetables that you can buy over the year?	Partly	Yes	No	Yes
Are you content with the diversity of vegetables that you can buy over the year?	Yes	No	No; particularly beans, lettuce, tomato and cucumber	No; particularly lettuce and ball cabbage

Conclusions

Our study indicates that marketing of vegetables is poorly developed in the Solomon Islands. There are many issues that affect the marketability of vegetables in the Solomon Islands, including high prices of produce in the market, which is largely a reflection of high transport costs; limited market access; and poor quality and shelf life. These issues could be addressed in a number of ways, which include increasing market outlets as well as aggregating farm produce through collection points with suitable storage facilities. This will help provide larger quantities of vegetables to the market, reduce transport costs, and stabilize supply and demand of quality produce.

Women are highly involved in the vegetable value chain in the Solomon Islands. Siliota et al. (2009) had previously shown a high participation of women in the cultivation of vegetables. The present study indicates that their involvement in marketing is even more important and that the typical customer is female as well as. Thus, women should be the target group for technology and information dissemination on vegetable production but also on health and nutrition aspects from the consumers' point of view.

One of the characteristics of the two markets surveyed is the lack of intermediaries. Auki Market is largely a farmer's market; only 4% of vendors bought vegetables from others. Even in Honiara Central Market, the main market of the country, our results showed 29% of the vendors buy produce from others. The low involvement of intermediaries has been noticed before (Kastom Gaden Association, 2005), and several reasons were proposed: 1) a perception that higher returns can be achieved by cutting out intermediaries; 2) poor telecommunications; 3) lack of confidence in the marketing chain (i.e. a widespread perception that middlemen are "cheating" farmers out of their returns; and 4) the fact that farmers subsidize trips to Honiara or other local centers through the trading of produce. There are adverse consequences of such high farmer involvement in produce marketing, such as high marketing cost (i.e. for transportation) resulting in higher consumer prices and lower returns to farmers, poorer quality of vegetables, inconsistency in supply flows, and limited market outlets.

No standard unit is used for retailing, and the unit size could vary during a market day. This leads to a lack of transparency and difficulty for customers to assess the real price of the produce. The main customers are individual households but restaurants and traders play a role as customers in Honiara and Auki. Restaurants are a special customer group that may seek more exotic types of vegetables. Interviews with staff of four restaurants in Honiara indicated that they are generally content with the quantity and quality, but not with the diversity of vegetables. Some restaurants have made direct purchases from specific farmers or vendors for specific kinds of vegetables. Farmers could target these special customers for contract production arrangements in the future. This would reduce farmers' marketing risk, improve product quality, and assure the variety of produce that restaurants are looking for.

Transportation is difficult and costly. The aggregation of produce to reduce transport costs would require the involvement of intermediaries. However, this does require the establishment of trusted relationships between traders and producers. NGOs could assist in this process by providing reliable market information to producers. Establishing farmer groups or cooperatives to market produce commonly could also improve the bargaining power of farmers in front of traders. Especially the differences in price and variety of vegetables between the markets in Auki and Honiara could be used to establish trade links that benefit both the producers and consumers. While the Honiara Central Market is almost eight times more important in terms of the volume traded, it is 13 times more important in terms of the value of produce sold here compared with Auki market.

The study revealed that tomato and sweet pepper are sold by a large number of vendors but that the mean quantities sold are relatively small. This might indicate that the crop yield was limited by possible production constraints or that farmers allocate only small areas to these crops. Further research should look at this aspect to identify the reasons for the low supply of these popular crops so that producers can be assisted to increase their production.

Traders' perceptions on the difficulty or ease of selling vegetables could be related to the supply and demand dynamics in the two markets. The information should serve as a guideline to modify production timing. For example, supply of fruit-type vegetables from February to April for Honiara Central Market could be increased, if farmers could sow or transplant the crop from November to January.

In general, traders are either satisfied or indifferent on both production and quality-related traits of the vegetable crops they are selling. This could imply the lack of exposure to diverse varieties. This is supported by the fact that only 19% of the traders have tried to sell new varieties. Traders believe that vegetable buyers are not very receptive to the new varieties being offered in the two markets. Participatory selection of new varieties by farmers and customers is important to ensure the acceptance of a new variety. Because different preferences were observed between traders in the two markets, selection should be conducted locally.

This study gives a better understanding of the marketing of vegetables in the Solomon Islands. Joint efforts among stakeholders would be required to greatly improve the marketing sector from the production side to generate a more diverse and stable supply, from the infrastructure side to install more outlets and storage facilities, and from the business side to engage farmers with middlemen or for contract production. With improvements along the marketing chain, farmers would be able to generate more income.

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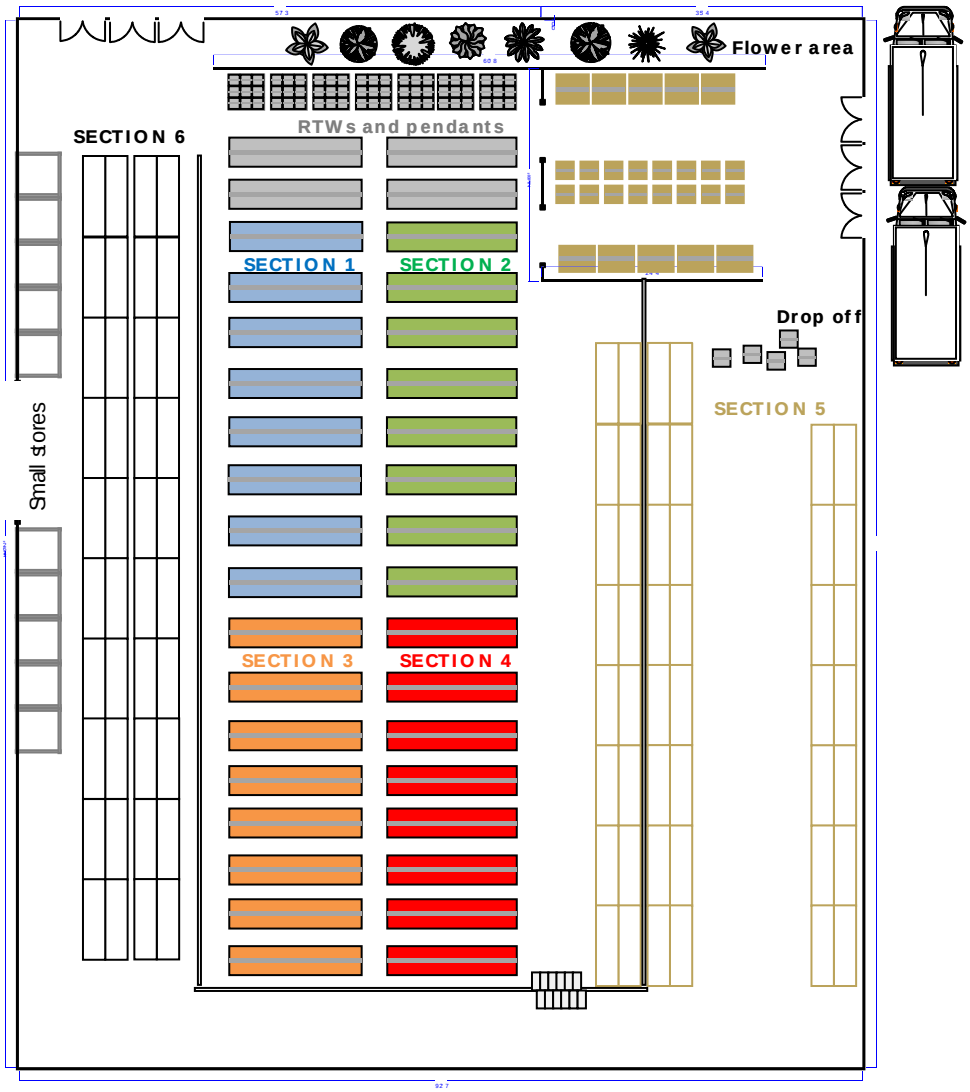
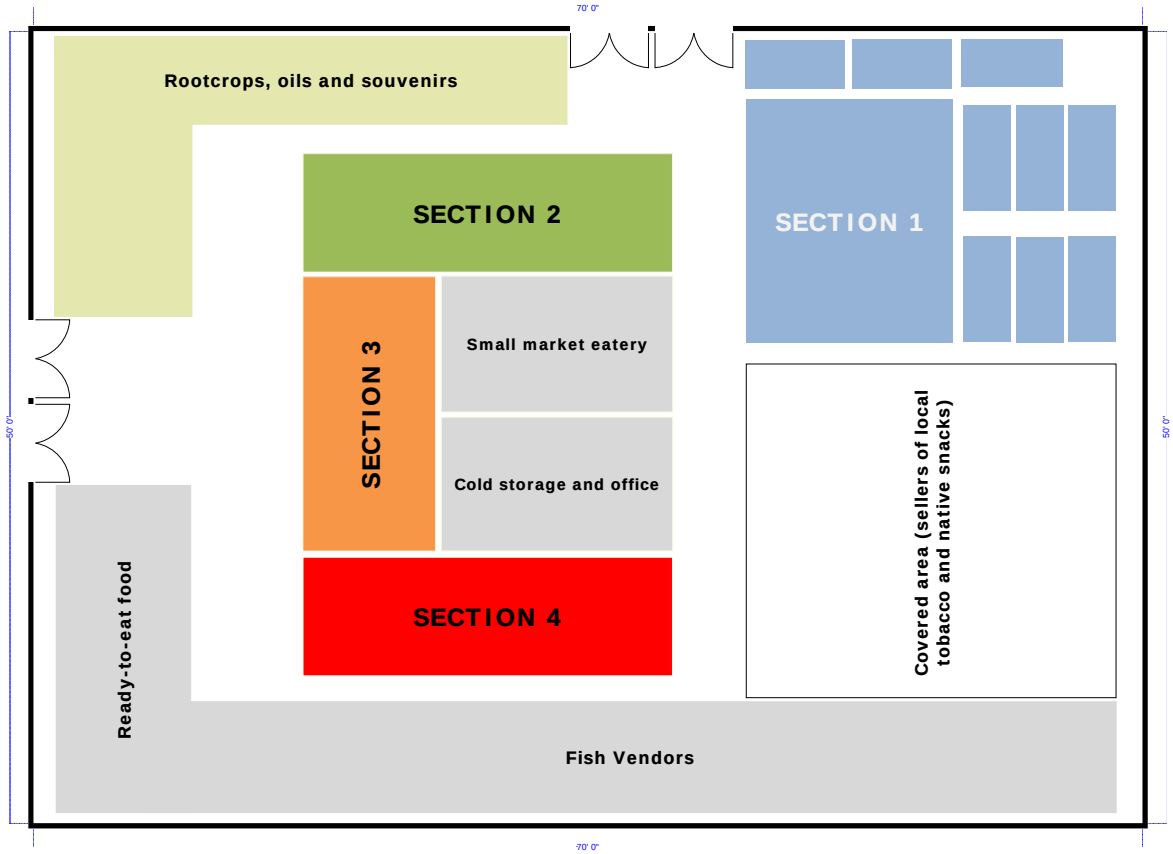
Annex 1: Market Sectioning

Honiara Central Market (surveyed December 1-12, 2009)



Legend: small shaded and unshaded boxes – market vendors on mats
Section 1: (Tuesday-Wednesday) blue boxes
Section 2: (Thursday) green boxes (shaded and unshaded)
Section 3: (Friday-Saturday) orange boxes
Section 4: (Monday) red boxes beside small stores
Section 5: (Tuesday-Wednesday) brown boxes (shaded and unshaded)
Section 6: (Thursday and Saturday) black unshaded boxes

Auki Market (surveyed November 21-26, 2009)



Legend:
Blue smaller boxes: vegetable vendors on tables (with fewer quantities sold);
Bigger boxes by Section: vegetable vendors on mats
Section 1: (Saturday-Monday) blue boxes (upper right side)
Section 2: (Tuesday) green box (facing entrance)
Section 3: (Wednesday) orange box (facing exit)
Section 4: (Thursday) red box (facing fish vendors)

Annex 2: List of institutions contacted

Province / type of institution	Institution	Person(s) interviewed (function)	Status[1]
Guadalcanal			
Government institutions	National Referral Hospital (NRH, or Central Hospital or Number Nine)	Ms. Sarah Fekaul (Dietician), Ms. Ela Nesi (Kitchen Supply Officer) and Mr. Cavner Tanabose (Hospital Secretary)	√
	Rove Prison Headquarters	Mr. William Reahaia (Deputy Commandant) and Mr. Jason Maso (Kitchen Supervisor)	√
	Honiara Central Market	Mr. George Leamana (Market Master)	√*
Hotels	Solomon Kitano Mendana Hotel	Mr. Adolf Volkmann (Executive Chef), Mr. Lynnold Jacob (Purchasing Officer) and Ms. Helvine (Stock Manager)	X
	Honiara Hotel	Ms. Sina Pongi (Purchasing Officer)	√
	Iron Bottom Sound Hotel	Ms. Vivian Marissa Villanueva (General Manager)	√**
	Pacific Casino Hotel	Mr. Starsky Sanchez (Hotel Manager) and Mr. Samuel Sanchez (Executive Chef)	√
	King Solomon Hotel	Ms. Francine Ega (Purchasing Officer)	√
Restaurants	Sea King Restaurant	Mr. Tai Hsing (General Manager)	X
	Aloha Restaurant		X
	Hong Kong Palace Restaurant		X
	Jina's Restaurant	Mr. Mark Bao (Kitchen Assistant)	√
	Nicky's Restaurant		√**
Malaita			
Government institutions	Kilu'ufi Hospital	Mr. Sherwin Auro-Don (Catering Officer)	√
	Auki Market	Mr. George Waleka (Market Master) and Mr. Henry (Fee Collector)	√*
Restaurant	Rarasu Motel and Restaurant		X

[1] "√" – interviewed; "X" - not interviewed; "*" - During the interview, no price and volume data provided; "**" - Provided price and volume data only and no interview

Annex 3: Photographs of vegetable varieties shown to vendors to elicit their preferences

This Annex is included in the electronic version of this report, accessible at:
http://libnts.avrdc.org.tw/fulltext_pdf/EB/2006-2010/eb0138.pdf

If you wish to receive a soft copy, kindly email your request to:
socioeconomics@worldveg.org

All photos courtesy of the Known-You Seed Company, Ltd., Taiwan
http://www.knownyou.com/

except #6 Bulb onion, **University of Illinois Extension**
http://urbanext.illinois.edu/

Cabbage

1 purple-red leaves, medium-large, thick oblate head

2 blue-green leaves, medium-large, peach shape head

3 purple-red leaves, medium-large, flat globe head

4 dark green leaves, large, flat globe head

Chinese cabbage

1 deep green and curled leaves, medium-large, compact and firm, awl-shaped inverted head

2 dark green head, medium-large, compact, large in size

3 dark green outer leaves, medium-large, heavy round head

4 dark green leaves, medium-large, well-wrapped head is compact and firm

5 dark green outer leaves, medium-large, elongated and firm head

6 light green outer leaves, elongated firm head, compact

Choysum

1 broad and thick green leaves, white stem

2 dark green leaves, thick stem

3 green leaves, yellow flower, shorter than flowering choysum

4 white stalks, green leaves

5 early flowering choysum, lots of yellow flower with green stem

6 green stalks

7 thick, crunchy stalks, yellow flowers and green leaves

Chinese kale

1 shot internodes and thick leaves

2 thick stems, leaf has lateral shoot

3 semi-erect, sturdy, whilte flowers and numerous shoots, smooth oblong green leaves

4 oval-shaped leaves, fresh green color with luster, prosperous side sprout

Pak choi

1 smooth leaves with thick petioles

2 plant with snow-white and smooth petioles, leaf is undulate, olive green & wrinkly surface

3 dark green and curled leaves

4 dark green curled leaves

5 erect, oblong green leaves and smooth

6 erect, slight curled oblong leaves and thick petioles

7 semi-erect, smooth leaves have beautiful shape with thick petioles

8 erect, green leaves with light green petioles

9 narrow and dark green leaves, petioles and flower stalks are shiny green

10 yellow-green leaves

11 erect

Tomato

1 globe to deep globe shaped, with dark green shoulder

2 pink and round

3 shiny red and oblong in shaped

4 green and round

5 oblate with uniform red color and shape

6 brighlty colored rind and deep globe in shaped

7 orange yellow and bright, round

8 oblate, with light green shoulder

9 pink and round

10 golden with oblong shaped

11 deep red and globe shaped

12 cherry red colored, peach in shaped, protuberant navel

13 pinky fruit, oblong and uniform

14 cherry colored and deep globe in shaped

15 slightly globe-shaped, orange-yellow and round

16 orange yellow and elongated

17 pink, pointed end and oblong in shape

Bulb onion

1 bulb-shaped, flat-topped, white-yellow skin

2 purple-red skin with white flesh tinged with red, medium-large

3 smaller, flat, skin thick and papery, flesh is pale yellow to light brown

4 red, shape similar to a torpedo or spindle

5 white inside, its layers of papery skin have a yellow-brown color

6 big globe-shaped, white bulbs

7 off-white flesh is usually tinged with green or magenta

Yardlong bean

1 purple-red color, long

2 long, light-green pods

Bitter gourd

1 dark-green, pointed and slender

2 bright-white, blocky

3 green, short, blocky and tapered

4 blocky, heavy warted curds on ribbed bright green skin and long

5 dark-green, spindle in shaped, many dark green curds

6 long-shaped fruit, with light green rind and flesh

7 bright fresh green color, smaller curds

8 bright-green, blocky and long

9 green, blocky and long

Eggplant

1 bluish-green fruit, green calyx, slim, long & smooth

2 blackish fruit, green calyx, oblong-shaped

3 purple-red fruit, purple-green calyx, long & thick

4 blackish fruit, green calyx, oblong-shaped

5 purple-red fruit, purple-green calyx, extra slim in shape

6 light-purple stripes, green calyx

7 white fruit, green calyx, uniform & slim fruit

8 purple-red fruit, purple-green calyx, long

Hot chili

1 thin, wrinkled, green when young & red when mature, 1.1cm in diameter

2 long-tapered shape, 3.7cm in diameter

3 semi-spreading plant, fruit is thin, firm, uniform, green when young & red when mature, 1.1cm in diameter

4 green fruit is smooth, thick and firm, 2cm in diameter

5 dark green leaves, fruit is uniform, smooth, young fruit is dark green & mature fruit becomes red, 1.5cm in diameter

6 Jalapeno-type fruit, smooth, green when young & red when mature, 1.8cm in diameter

7 thick flesh, 3.1cm in diameter

Sweet pepper

1 elongated bell fruit shape, green when young & red when mature

2 long bell fruit shape, green when young & red when mature

3 bell-shaped, green & yellow fruit

4 square-shaped fruit, dark green young fruit & brilliant yellow mature fruit

5 bell-shaped, purple when young, red when mature

6 square-shaped with thick wall, light green when young, orange when mature

7 square-shaped, dark green when young, orange when mature

8 dark green & shiny when young, red when mature, slender

9 elongated bell, green when young & red when mature

Cucumber

1 bluish-green, short cylinder in shape

2 light green, short cylinder in shape

3 glossy green, slim and long

4 glossy deep green, straight and chubby

5 glossy deep green, long and chubby, straight

6 light green and chubby

7 glossy green, long and chubby

8 green, long with rounded ends

9 brilliant green, slim and long

10 light green, straight with rounded ends

11 dark green, slim and long

Pumpkin

1 light red rind, thick orange-yellow flesh, flat fruit uniform in shape & size, oblate

2 grey-green rind, white, orange-yellow flesh, peculiar skin color, oblate

3 creamy-yellow rind, light yellow-white flesh, oblong

4 red-brown rind, orange-yellow flesh, oblate

5 grey-white rind, yellow flesh, medium, oblate

6 grey-green rind, orange-yellow flesh, medium, oblate

7 bright red rind, orange-yellow flesh, oblate

8 yellow-brownish rind, orange-yellow flesh, elongated

9 motled orange-yellow, golden-yellow flesh, elongated

10 motled orange-yellow, orange-yellow flesh, oval

11 oblate fruit with sutures, dark black rind, yellow flesh

12 whitish-green rind, white flesh, short stick shape

13 orange-red rind, orange-yellow flesh, oval-shaped

14 grey-green rind, orange-yellow flesh, medium, chesnut

15 yellow brown with spots, orange-yellow flesh, oblate

16 bluish-black rind, orange-yellow flesh, thick flesh, elliptical

17 bluish-black rind, yellow flesh, oblate

18 brown with spots, orange-yellow flesh, oblong

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