



# Research *in* Action 7

## Vegetable production, postharvest handling and marketing in Fiji



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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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## Executive summary

This analysis provides the results of a survey conducted with 80 vegetable farmers in Fiji's Sigatoka Valley, Cane Coastal Area, and Koronivia on Viti Levu. The objective of the survey was to understand the current practices of vegetables farmers and the constraints they face. These observations will be used to inform the implementation of two projects funded by the Australian Centre for International Agricultural Research and implemented by the Secretariat of the Pacific Community, University of Queensland, University of Sunshine Coast, and AVRDC – World Vegetable Center in partnership with the Fiji Ministry of Agriculture, Forestry and Fisheries. The projects aim to increase the production of high-value vegetables, in particular to supply hotels, resorts and supermarkets. This is seen as a priority for economic development in Fiji by the government as it will support sustainable livelihoods for farmers.

Key findings of the survey showed that:

- Most vegetable farmers in Fiji were smallholders (1-5 acres) that relied on family labor.
- The average income of vegetable farmers was in line with the national average income of rural households.
- The most common vegetables grown were tomato, eggplant and English cabbage.
- Only 10% of farmers sold produce to supermarkets, resorts or export markets.
- Most farmers sold their produce in large domestic markets in Suva, Nadi and Sigatoka keeping approximately 10% of their harvest for personal consumption.
- Only 12% of farmers sold through a vendor with most using a middleman or selling produce directly themselves.
- Market prices of vegetables are highly linked to supply in domestic markets with prices dipping during periods of high supply. This corresponds with the cool dry season in Fiji (August/September).

The survey also highlighted some key constraints. These constraints are mainly related to vegetable production rather than postharvest handling or marketing but the low level of farmers engaged in supplying resorts and supermarkets suggests they faced considerable challenges.

The key constraints include:

- *Fertilizer use is high but not sufficient.* A study on soil health in the vegetable production areas of Fiji revealed that nutrient availability and organic matters should be increased. Currently fertilizer use is limited to the application of NPK and Urea. Greater use of composts and manures could increase vegetable productivity.
- *Overuse or misuse of pesticides.* Nearly all farmers used one or more synthetic pesticides. It appears that common practice was to apply pesticide on a weekly or fortnightly basis rather than in response to visible pest damage or pests on the crop. Knowledge of the particular pests attacking crops or the appropriate pesticide for control also appeared to be low. This suggests there may be overuse or misuse of pesticides. Farmers identified pest damage as the greatest constraint to production.
- *Negative impacts of flooding.* Nearly all of the farmers (91% of respondents) were negatively affected by flooding but only a handful had taken any measures to guard against it, such as the installation of improved drainage systems. With expected increases in the intensity of rainfall in the coming years from climate change this is likely to become an increasing challenge.

- *Wastage in harvesting and postharvest handling of tomatoes.* Tomatoes are often harvested while they're still green (as opposed to beginning to turn red) and then ripened using the sun on the farm. Evidence from another study suggests that the high temperatures and differing rates of ripening means that approximately 19% of the harvest either fails to ripen or rots before being transported.

These findings suggest that emphasizing soil fertility and integrated pest management in extension work would support greater intensification of vegetable production. Pest management issues beyond the use of pesticides (e.g. crop rotation and identification of pests and diseases) in particular appear to be an area for intervention. For longer term support to vegetable production there is a need for more widespread installation of measures to reduce the negative impact of flooding. Work on postharvest handling of tomatoes is clearly justified.

There is also a need for further investigation into the practices of larger farms. In general, respondents with larger farms did not follow production practices commonly used by commercial farms. For example, they did not use a greater amount of permanent or contract workers, they predominantly served local markets rather than hotels, and they tended to sell their produce directly as opposed to using a middleman. The results could have been skewed since the number of respondents with farms greater than 10 acres was low (11% of respondents). Nevertheless, given the importance of commercial farms for the intensification of horticultural production in Fiji, this anomaly deserves further investigation.

## Introduction

The development of high-value crops for domestic consumption and export is seen as a priority for economic development and improved livelihoods in many Pacific island countries. The Fiji Ministry of Agriculture, Forestry and Fisheries (MAFF)<sup>1</sup> identified fruits and vegetables as among the six “priority concerns” for export promotion and import substitution. The government has identified cabbages, lettuce, tomatoes, capsicums, carrots, onions, potatoes, and peas as target crops for greater production. Hotels, supermarkets and restaurants are seen as key domestic markets.

In response, the Australian Centre for International Agricultural Research (ACIAR) launched two projects<sup>2</sup> in 2012 to support sustainable intensification of high-value vegetable production in Fiji. MAFF, Secretariat of the Pacific Community (SPC), University of Queensland (UQ), University of Sunshine Coast and AVRDC – The World Vegetable Center (AVRDC) are partners in the projects.

Understanding current practices and perceptions of vegetable farmers in production, postharvest handling and marketing enables the project team to design interventions to address constraints to expanding vegetable production and trade. Thus, one of the first activities of the two projects was to conduct a survey in project target areas to collect the information. The findings presented in this situational analysis are based on that survey.

The project target areas include the Sigatoka valley, Cane Coastal Area, and Koronivia of Viti Levu. The Sigatoka valley is the main vegetable production area in Fiji. It is estimated that around 80% of the total vegetable production occurs in the valley. The Cane Coastal Area and Koronivia were selected due to the presence of markets and communities willing to join the project participatory guarantee system activity<sup>3</sup>. These are the areas where the projects will conduct most of their activities.

## Survey methodology

Villages where vegetable production is a main activity were selected from the Sigatoka valley, Cane Coastal Area, and Koronivia on Viti Levu (Annex 1). The survey targeted existing farmer groups in these villages. The group leader was notified prior to the interviews. The leader then invited the group members to participate in the survey.

In total, 80 households were surveyed. The survey was conducted in the following villages: Nawamagi, Lokia and Nabitu in the Sigatoka East Bank; Raunitoga in the Sigatoka Mid-Valley; Qereqere and Barara in the Sigatoka Lower Valley; Biausevu, Komave and Namatakula in the Cane Coastal Area; and, Koronivia Road in Koronivia.

A structured questionnaire divided into the following sections was used to collect data: a) tracking information, b) socio-demographic information, c) farm information, d) production information, e) market information, f) capital and socioeconomic status, and g) training and extension needs. Production information was collected for up to three of the most important vegetable crops on each farm.

The survey team consisted of four enumerators (SPC and AVRDC staff: Suzanne Neave, Govind Raju, Nitesh Nand, Aloesi Hickee). They were assisted by MAFF staff (Makereta Rasuka, Ajay Chand, Sakeasi Ralulu, Unaisi

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<sup>1</sup> MAFF was the Ministry of Primary Industry at the time of the project.

<sup>2</sup>PC/2010/090 “Strengthening integrated crop management research in the Pacific Islands in support of sustainable intensification of high-value crop production” and PARDI/2011.03 “Developing an integrated participatory guarantee system in the Pacific Islands in support of sustainable production of high-value vegetable crops”

<sup>3</sup> The Participatory Guarantee System is the focus of the second project PARDI/2001/03.

Remudu). Each household was visited by a three-person team (two enumerators and one MAFF staff). Prior to undertaking the household survey a training session was conducted by Suzanne Neave at the Sigatoka Research Station on August 27, 2012. During this session, the survey team went through the questions and clarifications were made. A trial run was also made with farmers who visited the research station on that day. The survey was conducted from September 5 to October 3, 2012.

## Data constraints

Due to challenges in data collection and interpretation, some questions in the survey could not be analyzed. Annex 3 provides a detailed breakdown of the responses for each of the questions which provided usable data.

In interpreting the results attention should be paid to the difference between the percentage of 'respondents' and the percentage of 'responses'. For many questions in the survey, the respondents were able to give multiple answers. This means that sometimes answers are presented as a percentage of all of the answers provided, i.e. the percentage of responses. This is useful for identifying the most common answers but cannot be used to determine how many of the respondents gave that answer. For example, if 50% of responses were a certain answer this does not mean 50% of the respondents gave this answer. Care has been taken to indicate whether the result is a percentage of responses or respondents. Annex 3 also states the number of respondents and responses for each question.

## Findings

This section outlines some of the key findings from the survey conducted in Fiji. The presentation of the findings roughly follows the different sections of the original questionnaire. These findings have been supplemented where possible by other studies and publications.

### Farmer characteristics

The survey was conducted with 80 farmers from the Sigatoka valley, Cane Coastal Area and Koronivia with the greatest number of respondents (40%) located in the Sigatoka East Bank (see Table 1). Seventy-one percent of the respondents were 41 years old or more and they were almost exclusively male (94%).

The level of education of the respondents is broadly in line with the national average. Nearly all had at least attended primary school and 40% had gone on to attend secondary school, although only 8% completed it. The ethnicity of the respondents was approximately half Indo-Fijian (55%) and half i-Taukei (45%).<sup>4</sup>

Most respondents (76%) farmed in just one location, although 19 (24%) reported farming in two or more locations. Most respondents (58%) were also part of an organized agricultural group for production and marketing.

An annual income between \$5,000 and \$15,000 was reported by 49% of respondents. This is roughly in line with the national average. The average income of a rural household in Fiji in 2008/9 was around \$11,600.<sup>5</sup> It was, however, difficult to know if most of the farmers were at the top or bottom of this fairly broad income range. Overall, 40% of respondents reported an income below the group average, i.e. below \$5,001-\$15,000, and only 3% reported an income higher than the average (see Annex 3)<sup>6</sup>.

Table 1 breaks down some of this information according to the location of respondents. It shows that respondents in most areas reported an income range of \$5,001-\$15,001 except for respondents in the Cane Coastal Area, who most commonly stated annual income as between \$1,001-\$5,000. The average number of

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<sup>4</sup> I-Taukei is used to indicate indigenous Fijians.

<sup>5</sup> Fiji Bureau of Statistics, Household Income and Expenditure, June 2012.

<sup>6</sup> Other answers included, 'don't know' and 'prefer not to say'.

people per household in the Cane Coastal Area was also higher than the other areas. This does not mean, however, that in general incomes are lower in the Cane Coastal Area. The high standard deviation for the number of people in the households suggests that these results are being driven by a couple of extreme results.

**Table 1: Key farmer characteristics by location**

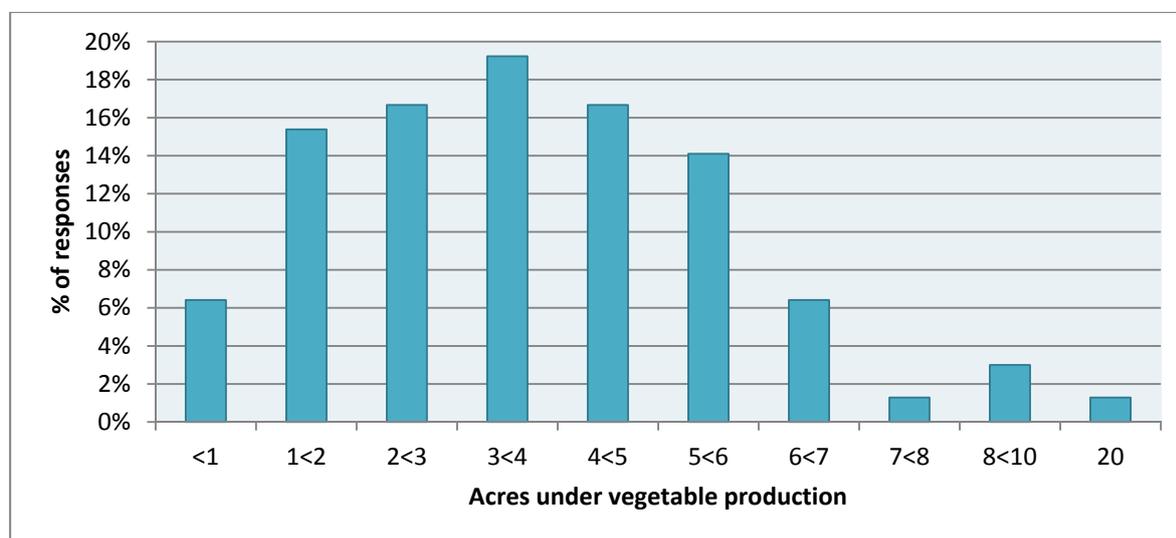
Location	% of respondents	Average no. in household	Standard deviation of no.in household	Average income bracket
Sigatoka (lower valley)	24%	3.9	2.5	\$5,001-\$15,000
Sigatoka (middle valley)	18%	3.9	1	\$5,001-\$15,000
Sigatoka (east bank)	40%	4.5	1.8	\$5,001-\$15,000
Cane Coastal Area	13%	6.8	4.2	\$1,001-\$5,000
Koronivia	6%	5.2	0.8	\$5,001-\$15,000

Vegetable production is the main source of income for 71% of respondents. This indicates that the targeting of the survey on key vegetable growing areas was successful. Other sources of income included growing fruit and root crops, and raising livestock.

## Farm information

### Land used for vegetable production

The size of farms of the respondents ranged from half an acre up to 27, acres although 5.8 acres was the average. This indicates that the majority of respondents are smallholder farmers. The area of land used for vegetable production also varies widely but mainly falls between three and four acres (Fig. 1). Overall, the average amount of land used for vegetable production was about two thirds of total farm size (Table 2).



**Figure 1: Area of land used for vegetable production (% of responses)**

Table 2 shows that the average percentage of land used for vegetable production is highest on small farms between one and five acres. Variability in the use of land for vegetable production increased with the size of farms. This is shown by the high standard deviation for average land used for vegetables when farm size is between 20-30 acres. For example, one farmer had 10 acres of land but used only 0.3 acres of it for vegetable

production, whereas another had a farm of 27 acres and used 20 acres for vegetable production<sup>7</sup>. Vegetable production may be preferred by farmers with smaller landholdings because it provides relatively quick income whereas farmers with larger landholdings are able to diversify into longer term crops such as fruit trees or root crops.

Table 2: Farm size and area of land under vegetable production

Area of farm (acres)	% of responses	Average farm size (acres)	Standard deviation of farm size	Average land for vegetables (acres)	Standard deviation of land for vegetables	Average % of land used for vegetables
<1	4%	0.57	0.06	0.23	0.05	42%
1<5	46%	3.32	0.92	2.55	1.11	77%
5<10	38%	6.48	1.43	4.07	1.57	64%
10<15	6%	11.80	2.95	4.75	2.95	40%
15<20	3%	15.50	0.50	5.00	4.00	31%
20<30	3%	24.50	2.50	13.00	7.00	51%
Total	100%	5.83	4.39	3.52	2.67	66%

### Land tenure

Land tenure for agriculture in Fiji consists of freehold land, crown land and native land. Native land is a customary land tenure system and refers to land which is communally owned by the *i-Taukei*.<sup>8</sup> Native land can be used for agriculture by the original Mataqali owner-occupants ('Mataqali land') or can be leased to other farmer occupants through the Native Land Trust Board ('NLTB land'). According to the 2009 Agricultural Census, 66% of agricultural land in Fiji was either Mataqali (35%) or NLTB land (31%).<sup>9</sup>

The most common form of land tenure for the respondents of the survey was Mataqali land (41% of respondents). Other common forms were freehold (25%) and NLTB leases (20%)<sup>10</sup>. Farmers with freehold land have a slightly higher average size of farm than farmers under other systems.<sup>11</sup>

### Main crops

Farmers were asked to name their three main crops. Answers included more than 18 different crops although tomatoes, eggplants and English cabbage<sup>12</sup> were by far the most common (Fig. 2).

<sup>7</sup> The respondents with large farms who used a low percentage of it for vegetable production tended to grow root crops.

<sup>8</sup> Department of Lands and Surveys, Land Tenure Systems in Fiji.

<sup>9</sup> Fiji National Agricultural Census, 2009, Department of Agriculture, Economic Planning and Statistics Division.

<sup>10</sup> The remaining answers were mainly sharecropping or combinations of sharecropping with Mataqali, NLTB or freehold.

<sup>11</sup> Average farm size for freehold land is 7 acres, in comparison to 6 acres for NLTB leases, 4 acres for sharecropping and 5 acres for Mataqali.

<sup>12</sup> This terminology is used in Fiji to distinguish between Chinese cabbage (otherwise known as bok choy or pak choi)

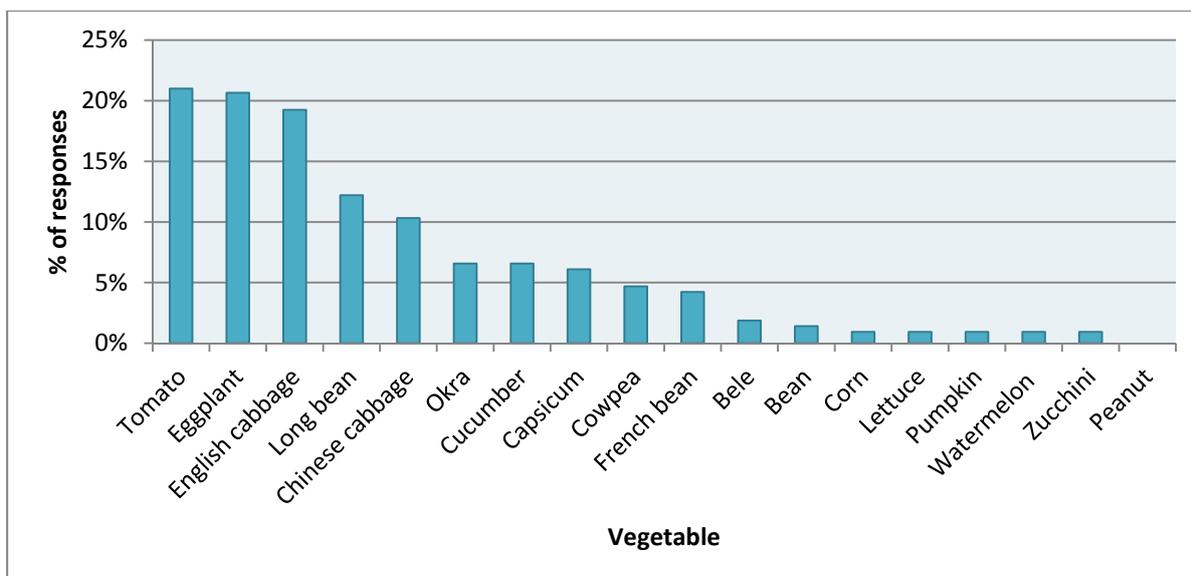


Figure 2: Main crops under production (% of responses)

Respondents were also asked to estimate the amount of land used for different vegetables (Fig. 3). Tomatoes, eggplant and English cabbage are still the top three crops under production. Although a greater number of farmers are growing eggplant, the area of land used for eggplant production is actually lower than that of English cabbage.

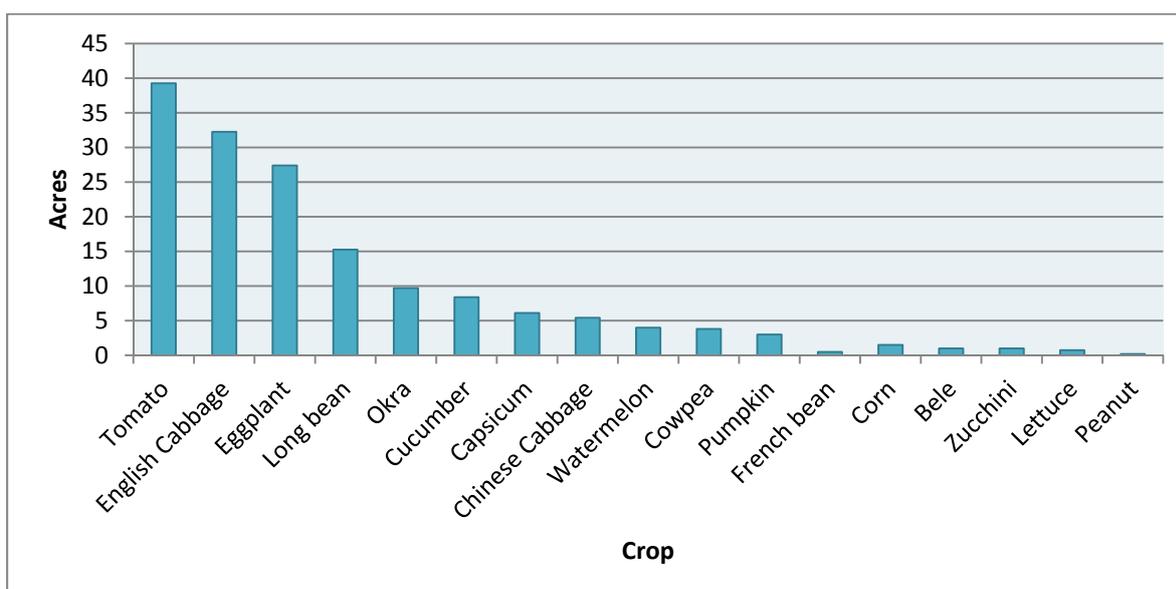


Figure 3: Area of land under production (acres per crop)

### Rotations and seasons

The peak season for vegetable production is around August/September. In Fiji the hot months are December to April; humidity and rainfall are also high in these months. The cool season is from May to November. Consequently, vegetable production peaks around the mid-point of the dry cool season. Annex 2 provides temperature and rainfall information for key locations on Viti Levu.

Most respondents do not change crop varieties for the different seasons but they do tend to rotate the type of crop grown. Sixty-five percent of responses revealed rotations between two or more kinds of vegetables and 25% of the responses reported rotation between vegetables and cereals such as maize. Rotation is a good

practice to avoid build-up of soil-borne disease; this is particularly important for smallholders who have limited land area and are more likely to monocrop.

Leaving land fallow appears to be an uncommon practice, with 64% of responses reporting never leaving the land fallow. Only 12% of responses revealed fallow periods before and after vegetable production. Such intensive land use is likely to have negative impacts on soil fertility and to lead to land degradation.

### **Land characteristics**

The majority of respondents (85% of responses) reported farming on flat land. No farmers reported vegetable production on land with a slope of 15° or more. Some care should be taken with this result, since national guidelines discourage farming on land which slopes 15° or more. In fact, it is often included in lease agreements between landowners and tenants with the NLTB and the Land Use Department of the MAFF. Consequently, respondents may have been unwilling to reveal practices that went against the recognised guidelines. The region as a whole is known to be suffering from high levels of land degradation. This is due in part to intensive cultivation of sloping land<sup>13</sup>, mainly attributed to the intensification of sugar cane production rather than vegetables.

The finding on the slope of the land is consistent with subsequent findings regarding flooding. When asked about events affecting their farm in the last 5 years, 91% of the respondents reported experiencing floods. The most cited years of flooding events were 2012 and 2009, which correspond with the dates of the largest floods experienced on Viti Levu in recent years. The 2009 flood was one of the worst floods experienced since 1931, with western Viti Levu being one of the worst affected areas. Heavy rainfall was experienced for more than a week and most low lying areas were underwater for days; some places experienced flood levels of up to 3-5 meters<sup>14</sup>. Since horticultural crops are typically planted on low-lying land, the floods had a hugely detrimental impact on vegetable production. Most of the farmers surveyed were located near the Sigatoka River, which is prone to flooding and explains their high exposure.

Climate change projections for Fiji predict increased intensity and frequency of extreme rainfall with high confidence<sup>15</sup>. This means that challenges caused by flooding are likely to increase. Interestingly, only 10 farmers reported the installation of improved drainage systems despite the high level of flooding experienced.

A subsequent study on soil health was conducted by AVRDC and MAFF in the vegetable growing areas considered in this analysis. The study looked at 11 different measures of soil health for 15 locations in the Sigatoka valley, Cane Coastal Area and Koronivia. The findings showed that all of the farms had 'moderate' soil health, which means that on average measures such as texture, microbial activity, pH values etc. were in the middle of the range from poor to good. The main concerns were low soil fertility and low levels of organic matter in the soil. The study recommended that farmers add organic matter to the soil, rotate crops and use cover crops to help increase the fertility of the soil.

### **Land preparation**

Overall, farming is done by hand, sometimes with animal traction (56% of responses). A significant number of respondents reported combining animal traction with the use of a tractor but only a handful (4 respondents) use a tractor without hand or animal traction.<sup>16</sup> There were few obvious commonalities amongst the respondents who do use only tractors: the size of their farms ranged from 2 to 22 acres and they were located in different areas.

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<sup>13</sup> Identified direct causes of land degradation in Fiji as described in the 2007 'National Action Plan to Combat Desertification/Land Degradation and to Mitigate against Drought', included intensive sloping land cultivation.

<sup>14</sup> 'Economic Costs of the 2009 Floods in the Fiji Sugar Belt and Policy Implications', Padma Lal, Rashmi Rita and Neehal Khatri, 2009.

<sup>15</sup> Climate Change in the Pacific: Scientific Assessment and New Research. Volume 2: Country Reports, Fiji, p. 87.

<sup>16</sup> Surprisingly, only one of the respondents who reported only using tractors had a farm larger than 9 acres. They also all had a range of incomes and dependence on vegetable production for income.

The most common form of land preparation was the use of an animal and a disc plough or harrow. Farmers reported a wide range of depth for tillage, but 38% of responses were at a depth between 11-15 centimetres. Tilling the land is mainly done just before planting. The majority of the time crop residue is ploughed back into the soil, although 40% of responses indicated residues were removed from the field.

### Roles and responsibilities

The number of people working on the farms ranged from one person to six but the most common answer (42% of respondents) was that just two people worked on the farm. There appears to be some correlation between farm size and the reported number of workers on the farm (Table 3) although perhaps the relationship is not as strong as might be expected.

Table 3: Average number of workers by farm size

Area of farm (acres)	Average number of workers
<1	2.7
1<5	2.6
5<10	3
10<15	3.2
15<20	2.5
20<30	4.5

Respondents were asked about the type of labor used for different tasks. The different types included family labor, casual labor, contract and permanent staff. Overall, family labor was used for nearly all tasks. This is particularly true for the purchasing of inputs, selling produce, and administration, which was reported as almost exclusively done by family workers. Only nine farmers reported using permanent or contract workers. Casual laborers were used, often in combination with family workers, particularly for weeding, planting, ploughing and harvesting. Larger farms more commonly reported using family labor alongside casual labor but there was no strong trend amongst the larger farms to use more contract or permanent labor.

Respondents were also asked about the breakdown of tasks between men and women. Figure 4 shows the reported work division between male and female household members for different tasks in crop production. Some care should be taken in interpreting these results as 94% of the respondents were male. If a higher number of women had been included in the survey we might have found a different result.<sup>17</sup> However, it appears there are clear gender differences in farm work, with men doing tasks such as ploughing, input application and transport and women playing a greater role in tasks such as weeding, planting and harvesting.

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<sup>17</sup> In future studies of this kind greater attention should be paid to ensuring women's input into questions around roles and responsibilities, to prevent bias in the responses.

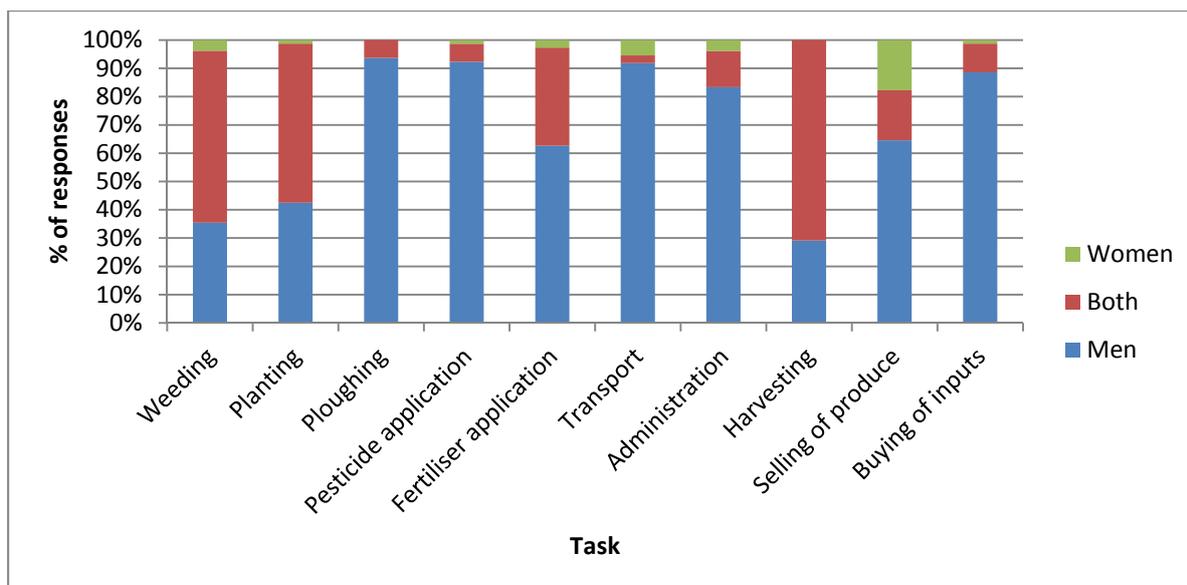


Figure 4: Roles and responsibilities for crop production between men and women (% of responses per task)

## Production of main crops

The following sections on production and postharvest handling focus on the results for the three main crops identified in the previous section, namely, tomatoes, eggplant and English cabbage. As capsicum is one of the crops targeted for export promotion and import substitution, analysis of capsicum has also been included where possible<sup>18</sup>.

Care should be taken when drawing conclusions from the results in this section. Analysis at the level of individual crops considerably cuts down the number of responses for each answer. A smaller number of responses mean that extreme or uncommon responses have greater potential to unduly influence the results, potentially making them less representative of common practices.

### Seedlings

The majority (84%) of farmers grew their own tomato, eggplant and English cabbage seedlings. Farmers who did not grow their own seedlings tended<sup>19</sup> to source them from MAFF or the Taiwan Technical Mission. Farmers who reported growing their own seedlings typically created seedbeds in their fields. Most (52%) farmers growing their own seedlings did not use any additional fertilizer for the seedbed. Thirty-four percent reported mixing NPK into the soil for the seedbed. The remaining farmers used either a combination of NPK and manure or compost, or used special potting mixes. An analysis of the quantities used for the mixes is unfortunately not possible<sup>20</sup> but it did appear there was some consensus on a quantity of between 30-50 g of NPK applied per square meter of soil.

### Fertilizers

Fertilizer use is extremely common. All but two of the tomato, eggplant and English cabbage farmers report using some type of fertilizer. The most commonly used fertilizers are NPK (13:13:21) and Urea (Fig. 5).

<sup>18</sup> Only 10 respondents mention capsicum as one of their main crops, so in some cases the sample size was too low to analyze. Capsicum is included wherever it is suitable to do so with appropriate caveats.

<sup>19</sup> Six of the 13 farmers who said they did not grow their own seedlings gave details of where they got them from.

<sup>20</sup> The data on the quantity used did not systematically give the amount of soil, or area of ground that was mixed with the fertilizer.

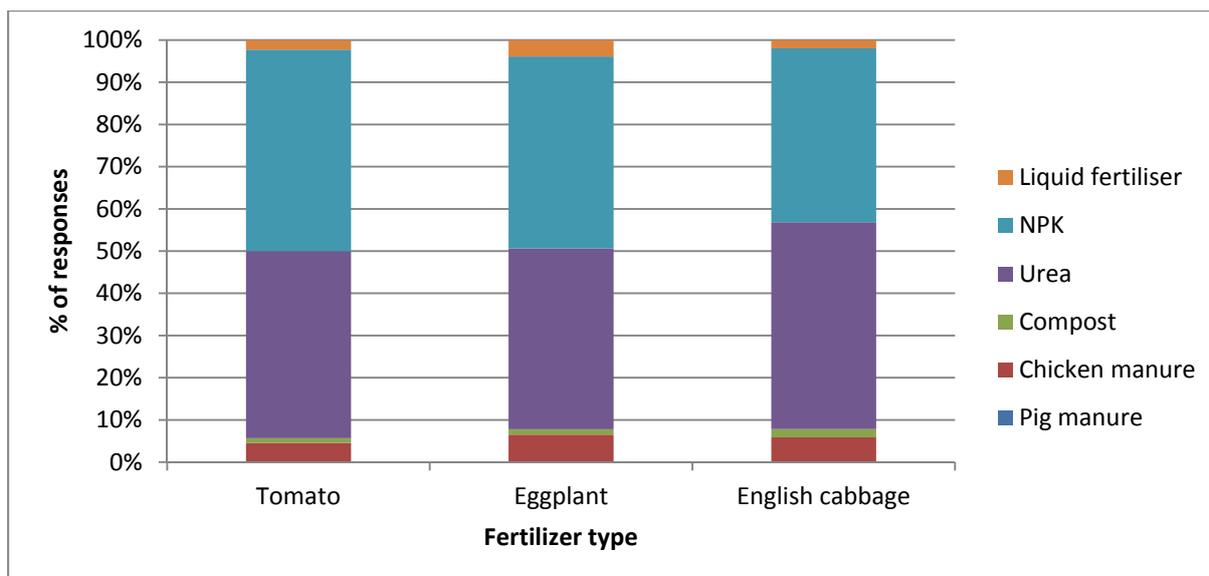


Figure 5: Fertilizer usage (% of responses per crop)<sup>21</sup>

NPK and Urea are most commonly applied together sometimes with another fertilizer such as chicken manure or liquid fertilizer but normally without. Table 4 shows that for tomatoes, eggplant and English cabbage the most common combination of fertilizer treatments is NPK with Urea. Only three respondents reported using another kind of fertilizer (in this case manure) without either NPK or Urea. Given the findings on soil health in the project area (see section on land characteristics) greater use of compost and manure would increase organic matter in the soil and be beneficial for soil fertility and vegetable production.

NPK is normally applied once or twice. If applied twice it tends to be first applied at planting and then again after three or four weeks or just before the vegetable flowers. If applied once it is typically done at flowering. Urea is typically applied just once, with NPK at planting.<sup>22</sup>

Table 4: Usage of Fertilizer combinations (% of responses per crop)

Combination	Tomatoes	Eggplant	English Cabbage
NPK& Urea only	70%	59%	65%
NPK & Urea & other	11%	7%	15%
Nothing	2%	2%	0%
NPK or Urea alone	7%	17%	15%
Other combination	9%	15%	4%

### Pesticides and pest control

Nearly all (93% of responses) farmers reported using some form of commercial pesticide. There was, however, much greater variation on which pesticides are used, in comparison to fertilizers, even among farmers of the same crop.

#### Tomatoes

For tomato farmers, the most commonly cited pests (43% of responses) were caterpillars. Other pests included whitefly, cut worm and aphids. The most commonly used pesticide was Superguard but there was a broad range of answers (Table 5) and Prevathon, Crop guard and Suncis were also commonly used. Thirty percent of farmers who used pesticides used more than one type.

<sup>21</sup> Please note that since combinations of fertilizers are used, this demonstrates the popularity of the different answers.

<sup>22</sup> Data was also collected on the rate of application but the huge variation in answers suggests there was a problem with the original data.

The frequency of pesticide application is high. Fifty-three percent of all of the responses indicated application of pesticides fortnightly, 11% for weekly application. Only 15% of responses reported applying pesticide in response to seeing pest damage or pest larvae on the plants.

Table 5: Usage of pesticides (% of responses per crop - top 5)

Tomato		Eggplant		English cabbage	
Pesticide	% of responses	Pesticide	% of responses	Pesticide	% of responses
Superguard	15%	Confidor	20%	Prevathon	47%
Prevathon	10%	Suncloprid	19%	Steward	21%
Crop guard	10%	Superguard	15%	Multiguard	8%
Suncis	8%	Chloroprid	9%	Crop guard	5%
Crop control	8%	Orthene	8%	Suncloprid	3%

### ***Eggplant***

For eggplant, the most identified pest was thrips and thrips in combination with mites or caterpillars. The most popular pesticides were Confidor and Suncloprid, although again there were a number of different pesticides reported.

Frequency of pesticide application for eggplant appears to be even higher. The most common response was a weekly application of pesticide (34% of responses) with weekly or fortnightly application making up 62% of all responses.

### ***English cabbage***

All English cabbage farmers reported using some form of commercial pesticide. Forty-six percent used more than one, with Prevathon being the most popular. The most common identified pest was caterpillars (42% of responses) however a large number of respondents were unable to identify particular pests. Many responses were noted the pesticide used was against 'insects' 'any worms' or 'unknown'.

A large number of farmers were unable to identify the particular pests that attacked their crops, but tended to use broad spectrum pesticides against unnamed insects, mites and bugs. One caveat to this statement is that, in the experience of SPC staff, commercial and semi-commercial farmers are very familiar with the pests that they deal with (as they deal with them year after year); instead, their struggle is to identify appropriate pesticides.

As with tomatoes and eggplant the frequency of pesticide application is high. Seventy-five percent of responses revealed a weekly or fortnightly application of pesticide. Only 15% of responses reported applying pesticide based on observations of pest damage, and only one farmer said it was in response to the stage of development of the plant.

### ***Capsicum***

There were only 10 capsicum farmers, so it was not possible to draw out any particular trends although the responses that were given are in line with those for tomatoes, eggplant and English cabbage.

### ***Pest management***

Information was gathered from respondents regarding the quantity of pesticide applied, cost of pesticide and time taken for application. Unfortunately, due to challenges in data collection, it is not possible to provide the results here. However, the concentrations of pesticide used do, upon initial inspection, provide a surprisingly low level of consistency even when looking at the same pesticide used on the same pests.

The most likely conclusion from these results is that pesticide is generally not applied in response to observation of a particular pest or at a particular stage of crop development. It appears that most farmers use

pesticides on a weekly or fortnightly basis regardless of the pest load on the crop. Interestingly, when asked explicitly how they make pest management decisions, the majority of respondents cited answers such as 'when damage is seen on the crop' or 'crop monitoring' (Fig. 6). This appears to be a direct contradiction of the previous answers.

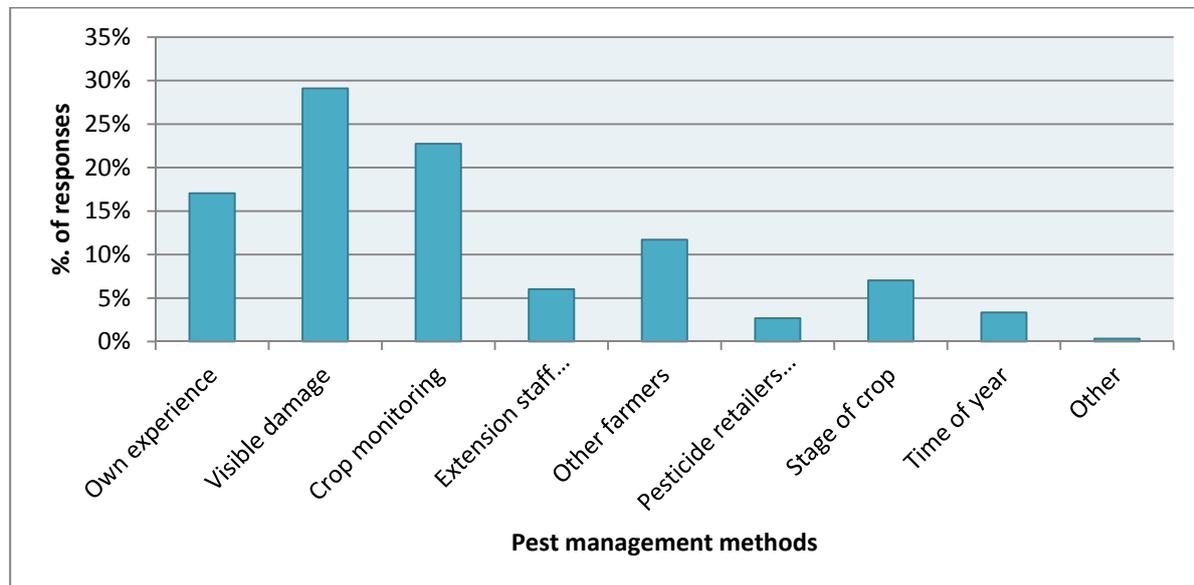


Figure 6: Influences for pest management (% of responses)

Note that all of the pesticides used were insecticides. It is not clear why pesticides to control plant pathogens were not used. Such a high use of insecticides suggests that farmers do not recognize the symptoms of diseases or perhaps there is a misperception that insecticides can also control plant diseases. Further studies are needed to understand farmers' knowledge, behavior and perceptions of integrated pest management.

### Irrigation

The most common form of irrigation across all four crops was by using a bucket or watering can (Fig. 7).

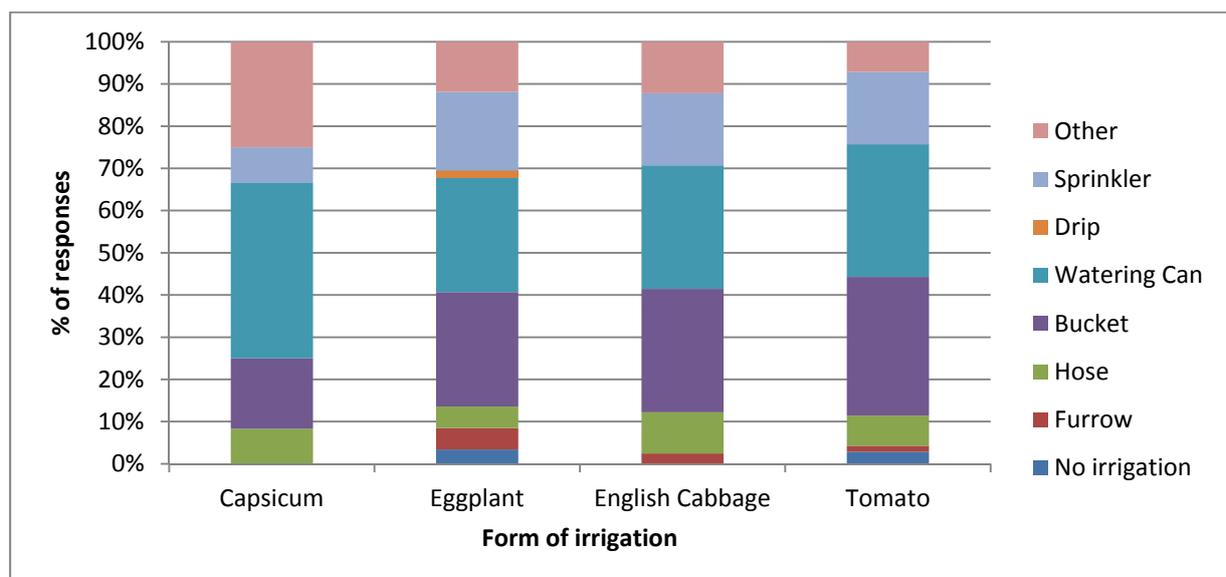


Figure 7: Forms of irrigation by crop (% of responses per crop)<sup>23</sup>

<sup>23</sup> Please note 5 of the 12 responses for capsicum were for watering can. Consequently, the percentage of responses was high, but based on a small number of observations.

The use of sprinklers was the third most common method overall and particularly used for eggplant<sup>24</sup>. A significant number (11% of responses) also named alternative methods, including flood irrigation and the use of spray backpacks to irrigate crops. These forms of irrigation were likely to be supplementary to rainwater. It is not known how many of the respondents had coverings over their crops, but it is likely to be relatively few.

### Constraints to production

Figure 8 shows the key constraints for production for each of the main vegetables. The greatest reported constraint for eggplant, English cabbage and tomatoes is severe pest damage. The second most common answer was 'other' (31% of responses to the question on the most important constraint). Most (60%) of the answers provided under 'other' were related to flooding and weather challenges. Clearly flooding is a key concern for vegetable producers. This correlates with the earlier finding that most of the respondents have experienced flooding in the last five years. Other constraints such as lack of capital, lack of irrigation, lack of new seed varieties etc., received a minority of the responses overall.

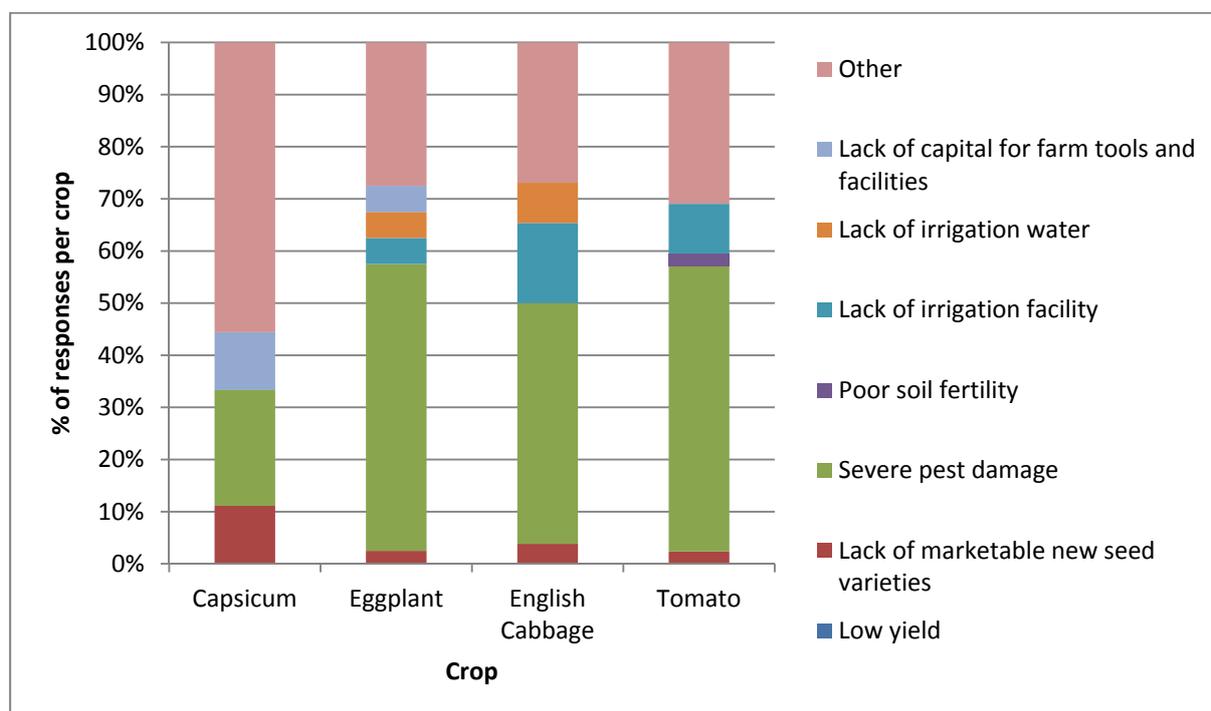


Figure 8: Main constraint to production (% of responses per crop)

A study conducted by Young and Vinning (2007) on horticultural production, which questioned 238 farmers in the Sigatoka valley and the Cane Coastal Area, asked a similar question regarding constraints. Interestingly they found that for tomato production the greatest constraint was lack of water irrigation with pests and disease coming in second. This could indicate that further clarification is required concerning major constraints tomato producers face, particularly around irrigation issues.

### Postharvest handling techniques

Early morning was the most common time of day to harvest produce for all crops except tomatoes, which were typically collected in the afternoon. Collection appears to be done quickly, with no respondents reporting a time between harvest and collection longer than a day. Tomatoes showed greater variability in the time of harvesting. This is because they were picked and allowed to ripen on the farm before being taken to market. They can, therefore, be harvested later in the day and most tomato farmers responded that they harvested in the afternoon (Fig. 9).

<sup>24</sup> Nineteen percent of responses regarding eggplant said that sprinklers were used for irrigation. This was the highest percentage of 'sprinkler' responses for any of the crops considered (see Annex 3, E12)

A study on postharvest handling of tomatoes in Fiji (Underhill 2013) found that tomatoes were left to ripen on the farm between one and four days after harvesting and before collection. It is recommended that tomatoes are picked just as their color begins to change from green to red. Interestingly, this appears to not be the common practice of most tomato farmers. Tomatoes were often picked while they were still green, and ripened on the farm. The consequences of this were twofold:

- 1) 8.9% of the harvest failed to ripen in time and was wasted; and,
- 2) Tomatoes were placed in high temperatures to precipitate ripening; 8.8% of the harvest was then lost as the tomatoes became overripe or rotted in the high temperatures.

It is likely that the current practices are the most convenient for the farmer, but these practices do lead to a significant loss of harvest and therefore profit.

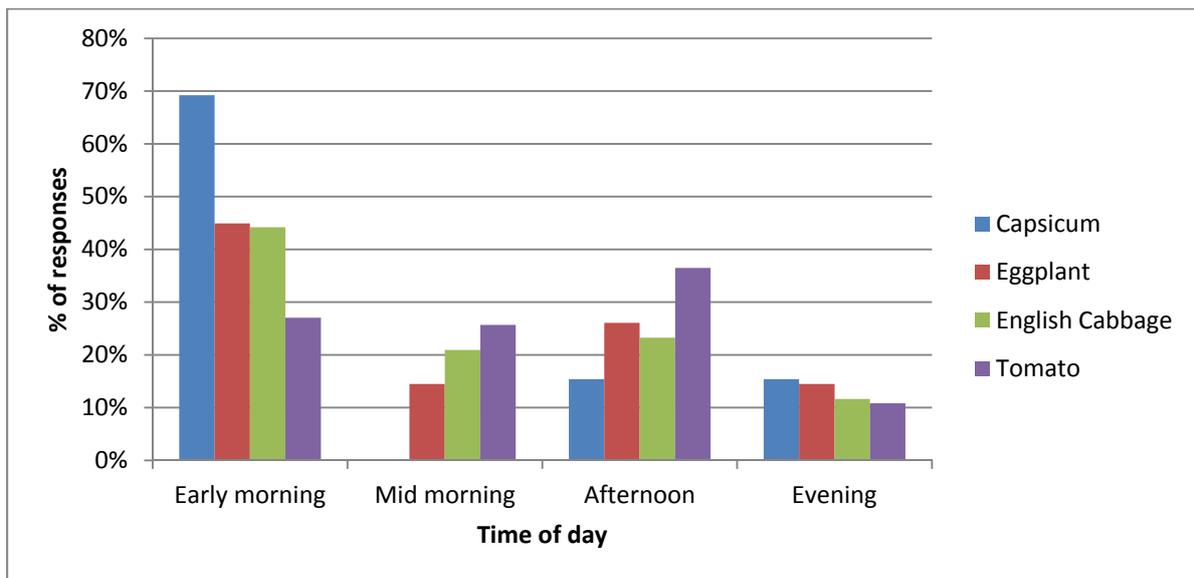


Figure 9: Time of day for harvest (% of responses per crop)

Once harvested, farmers typically filled bags with the produce, which were then kept on the ground or under the shade of a tree before being transported. This practice was used for all types of vegetables. However, there was some difference in whether produce was graded or not (Fig. 10).

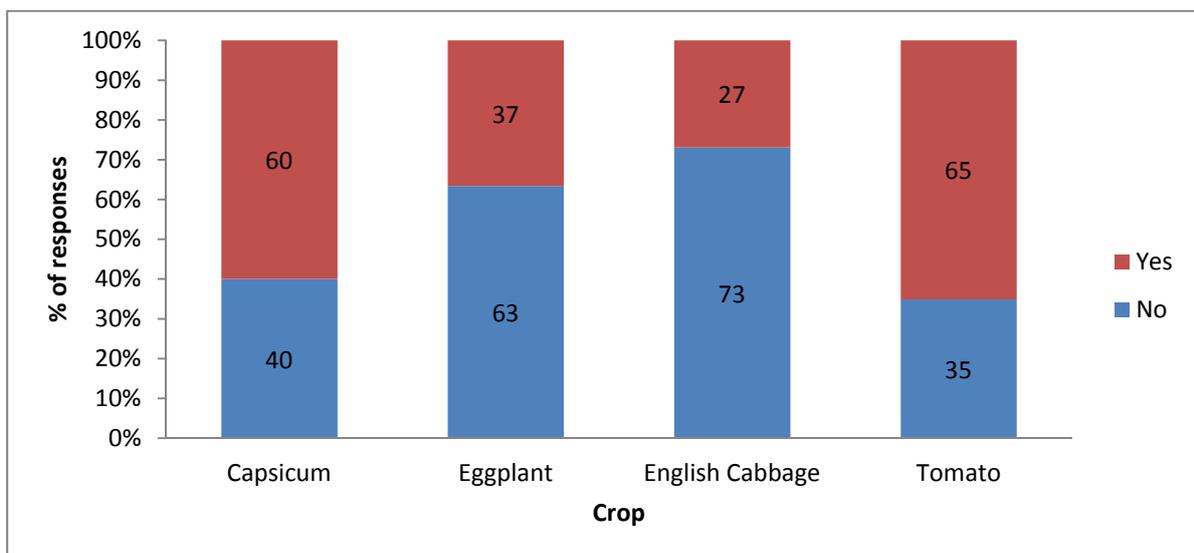


Figure 10: Grading/sorting of vegetables (% of responses per crop)

Postharvest grading was more commonly done for tomatoes and capsicum, whereas the majority of eggplant and English cabbage farmers said they did not grade or sort the crop after harvest. Sorting of tomatoes was done by a large number of criteria but the most important were the existence of blemishes, size and color.

Young and Vinning (2007) found that producers predominantly grade products according to the buyers' criteria. This suggests that buyers have more stringent criteria for capsicum and tomatoes.

Eggplant, English cabbage and capsicum were normally transported in various forms of bags, including flour bags, onion bags, crest bags, sacks and woven bags. Tomatoes were mainly transported in wooden crates, most likely to prevent bruising, which was an important grading criterion for tomatoes.

## Marketing

### Markets

The majority (58% of responses) of farmers sold their produce at local markets such as Suva, Sigatoka and Nadi. The questionnaire considered in this analysis did not cover transportation to market, but the study conducted by Young and Vinning (2007) revealed that transportation is a major issue for vegetable farmers. Table 6 shows the average distances travelled by producers. Approximately half (44%) of the producers interviewed had to transport their produce 10 km or more from the production place to their selling point. Nine percent had to transport it more than 50 km. Given the generally poor condition of the roads in these areas, transportation is often slow and expensive.

Table 6: Distances travelled by producers to transport produce to market

Distance to market (km)	Percentage of producers interviewed
0	10%
1-5	19%
6-10	27%
11-15	11%
16-20	9%
21-50	15%
>50	9%
Total	100%

Source: Young and Vinning (2007:84)

Only a minority (10% of responses) sold any of their produce to the export market or to resorts and hotels. Of the farmers supplying export markets and hotels, seven households were identified as selling a high percentage (more than 50%) of multiple vegetable crops to these markets. Interestingly, the average farm size of these households was just less than three acres. Also, none of the farms greater than 10 acres reported any sale for export and predominantly sold in local markets. This finding is at odds with expectations. This could indicate problems with the data but is worthy of further investigation in future work.

Typically, farmers kept around 10% of their harvest for home consumption. Farmers also tended to sell to just one key market, e.g. export market or a local market, and sold more than 50% of their produce to that one market.

### Sales channels

Most farmers sold produce to markets through middlemen rather than directly themselves (Fig. 11). Perhaps surprisingly, most respondents who sold multiple products to resorts or for export, reported selling the produce directly rather than through a middleman. Again, this is contrary to what we might expect from commercial farmers.

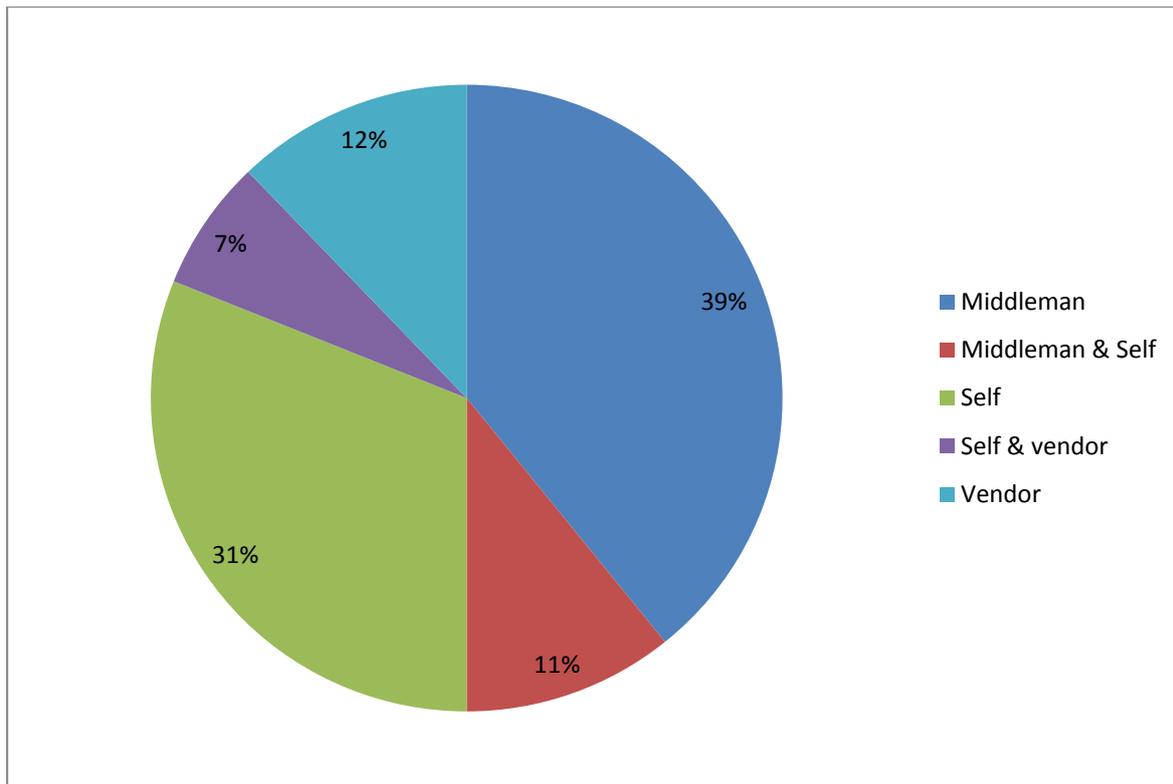


Figure 11: Sales channels, breakdown of responses (% of respondents)

### **Prices and seasonality**

Respondents were asked to note which months had low or high prices for their three main crops. Most respondents thought there was an increase in prices around March/April. Prices then dropped significantly around August/September and the end of the dry season. This did not seem to change no matter who sold the produce (e.g. middlemen, self or direct to vendors) or which crop it was.

When asked the reason for this, the most common answer was that it was due to increases and decreases in the supply of produce. High levels of supply around the main harvesting period led to depressed prices.

This corresponds with market data collected by MAFF. Figure 12 shows prices for the main crops considered in this analysis in 2011 and 2012. The prices were collected on a monthly basis and averaged for the main markets in Fiji. Prices increased from January to around May with a large drop in prices across all vegetables around September.

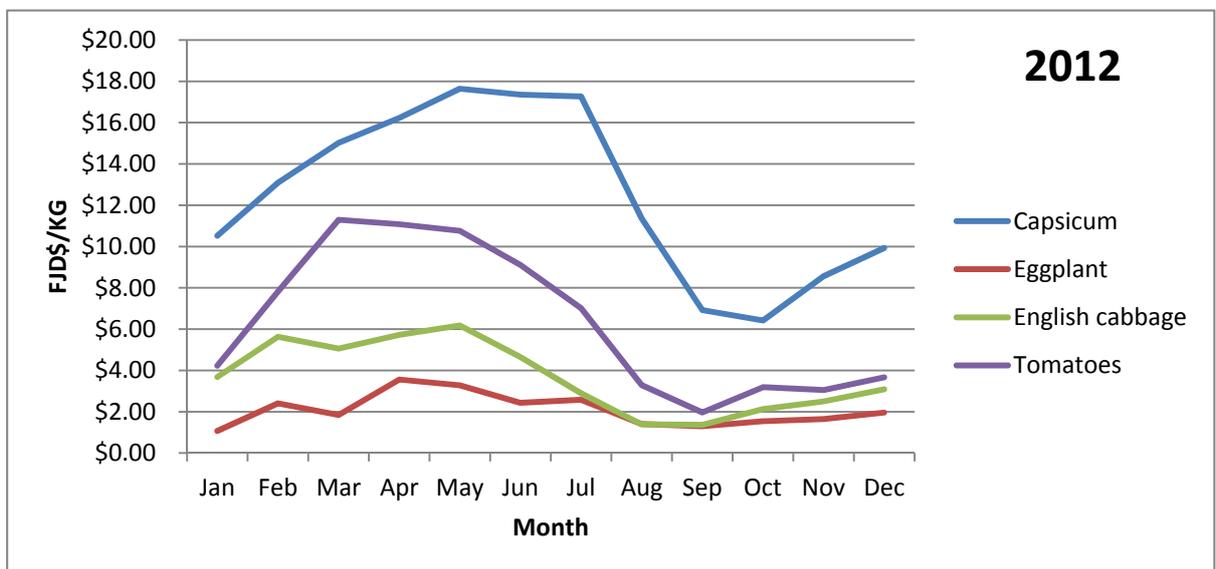
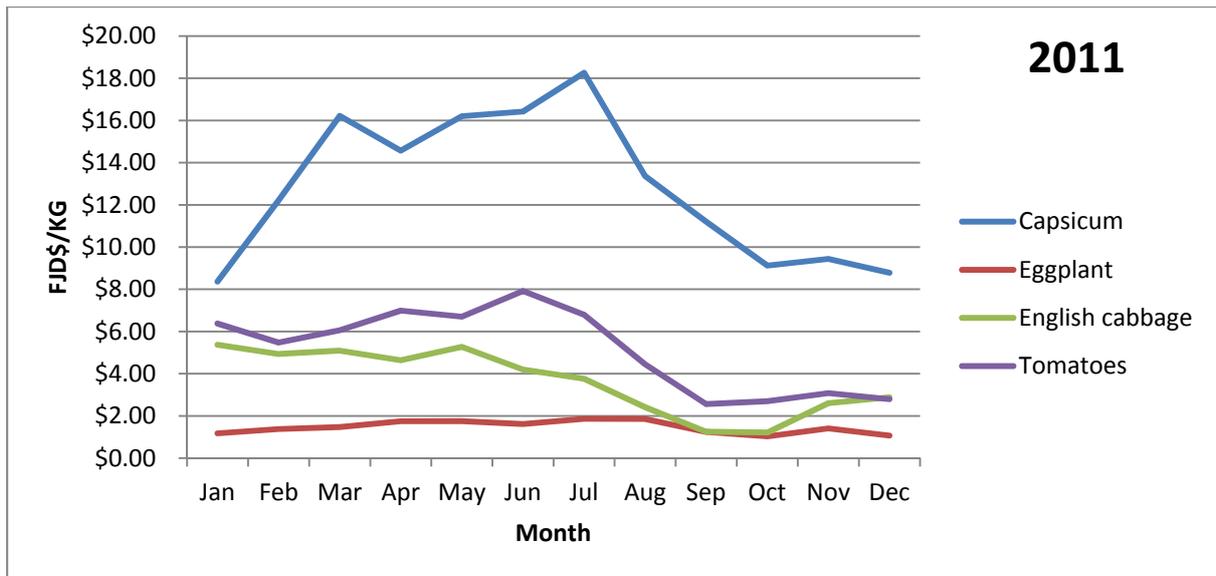


Figure 12: Prices for tomatoes, eggplant and English cabbage in main markets in Fiji (2011 and 2012)

Source: (AgTrade Unit, MAFF)

## Conclusion

Based on the results of this questionnaire, Fijian vegetable producers were predominantly male, aged 40 years old and above. They were mainly smallholder farmers that relied on family labor and worked the land by hand or with animal traction.

The most common vegetables produced were tomatoes, eggplants and English cabbage. Fertilizer use was very common but was generally limited to NPK and Urea, with very few farmers using other fertilizers such as manure. Since the fertility of the soil in the areas studied was often not optimal, greater use of manures and compost would be beneficial for vegetable production.

Pesticide use was also high with nearly all farmers using one or more pesticide. There was a large range of pesticides used despite a high level of commonality between the pests reported for the different vegetables. It appears that many farmers applied broad spectrum pesticides because either they were unable to identify the particular pest or disease attacking their crop, or could not select an appropriate pesticide. Farmers also applied pesticides frequently, most often on a weekly or fortnightly basis. Contradictions in the answers of the farmers regarding pest management suggest further research in this area would be warranted. Farmers identified pests as the greatest constraint to production for all of the main crops; it thus would be useful to understand why farmers choose the pesticides that they do and whether the high application rates are justified. Such insight would support the design of interventions to remove this constraint to the production of high value vegetables.

Flooding appears to be another constraint to production. Many of the farmers surveyed lived around the banks of the Sigatoka River and were regularly subjected to floods, particularly the catastrophic floods of 2009 and 2012. Perhaps surprisingly, only 10 farmers reported the installation of improved drainage systems despite the high level of flooding experienced. Addressing issues around flooding and drainage may be a suitable area for intervention.

Most farmers sold the majority of their produce in local markets such as Suva and Nadi. Typically they used middlemen to sell their products, although a high number of farmers also sold their produce directly. The reliance of producers on the domestic market means they were highly susceptible to highs and lows in prices driven by market supply.

Just 10% of farmers reported selling any of their produce to resorts, hotels or for export. Interestingly, these farmers were not the respondents with the largest farms but had an average farm size of just under three acres. In general respondents with larger farms did not conform to commercial production practices. For example, they did not use a greater amount of permanent or contract workers; they predominantly served local markets rather than hotels, and they tended to sell their produce directly. This unexpected result could be due to the small number of respondents with farms greater than 10 acres (9 respondents). Nevertheless, it would be interesting to investigate further the differences in vegetable production between farmers with different sized landholdings.

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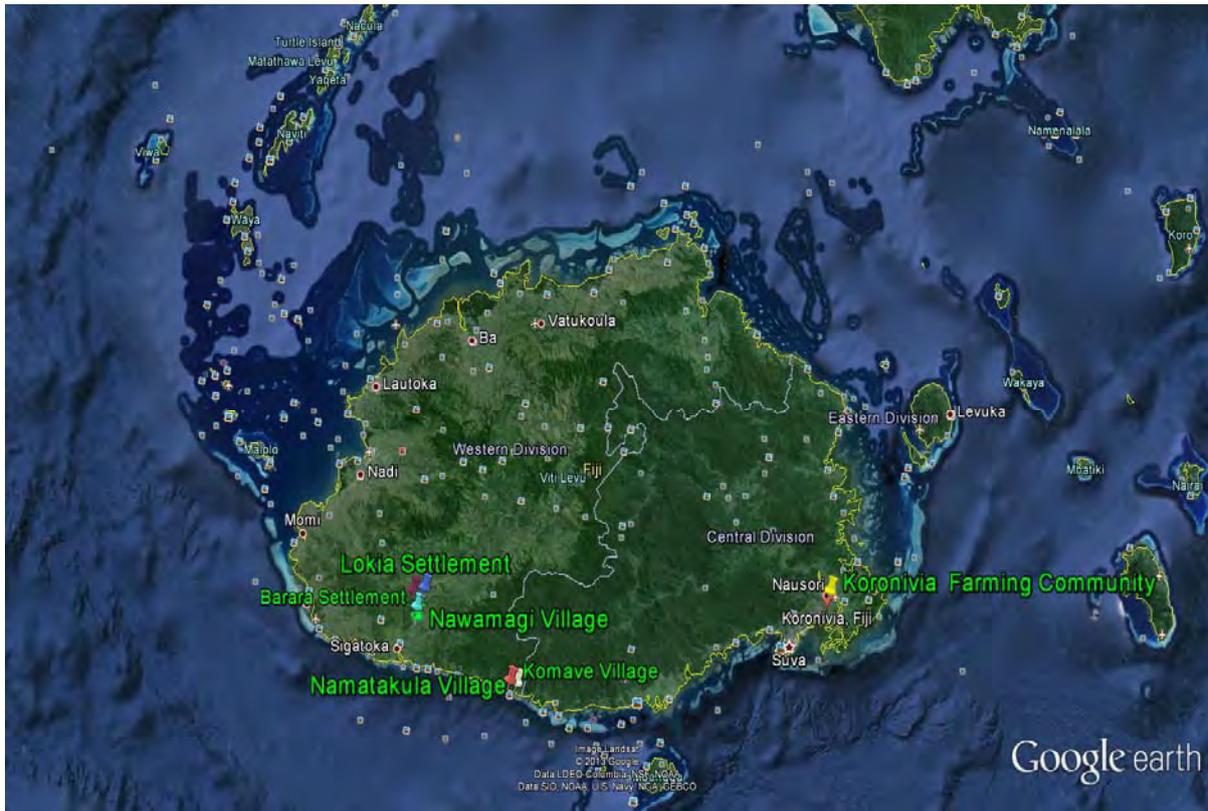
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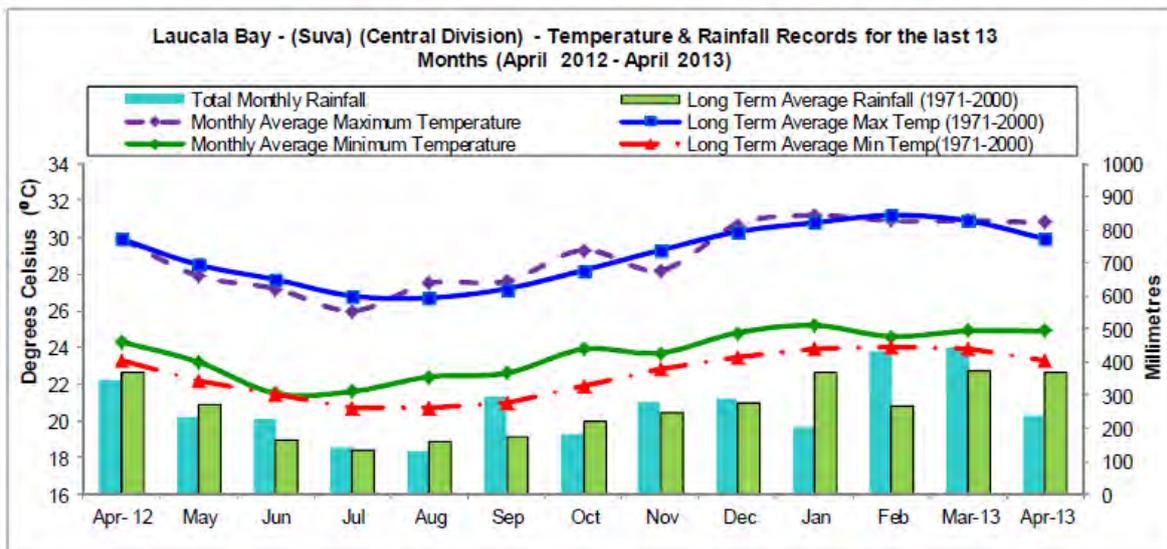
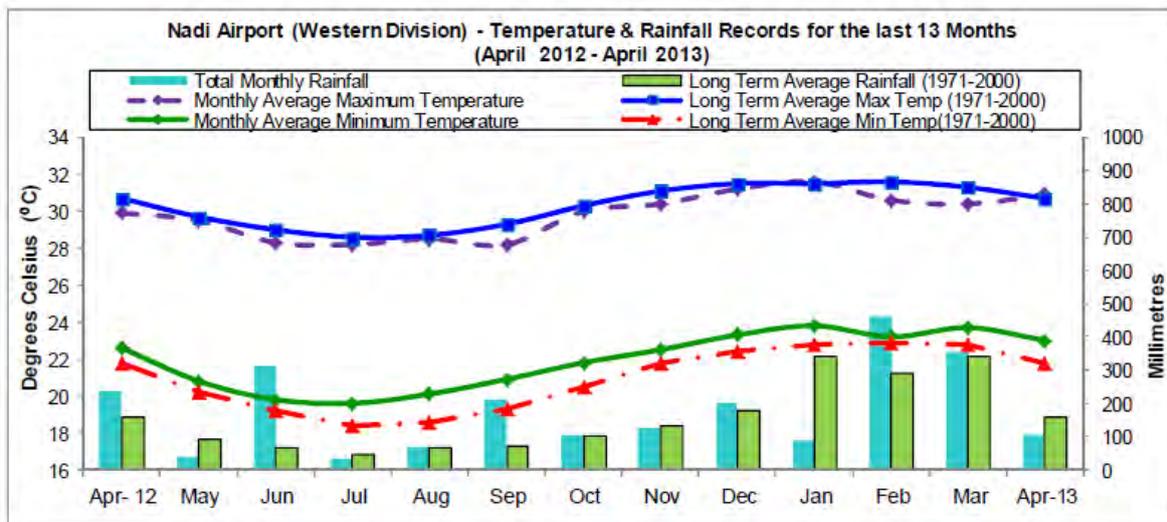
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## **Annexes**

Annex 1: Survey sites in Viti Levu



**Annex 2: Monthly temperature and rainfall of survey sites**



Source: Fiji Climate Summary April 2013; <http://www.met.gov.fj/Summary1.pdf>

Nadi data was used to represent Sigatoka and Cane Coastal Area, while Suva data was used to represent Koronivia.

### **Annex 3. Detailed breakdown of questionnaire**

## SECTION A: TRACKING INFORMATION

### A3: Form filled at:

Answer	No.	% of total
Sigatoka-Lower valley	19	24%
Sigatoka-Middle valley	14	18%
Sigatoka-East bank	32	40%
Cane coastal area	10	13%
Koronivia	5	6%

Total no of respondents	80
Total no of responses	80

## SECTION B: SOCIO-DEMOGRAPHIC INFORMATION

### B2: Age:

Answer	No.	% of total
Between 20 & 30	8	10%
Between 31 & 40	15	19%
Between 41 & 50	29	37%
Older than 50	27	34%

Total no of respondents	79
Total no of responses	79

### B3: Sex:

Answer	No.	% of total
Male	75	94%
Female	5	6%

Total no of respondents	80
Total no of responses	80

### B4: Ethnicity of respondent:

Answer	No.	% of total
Indo Fijian	44	55%
I-Taukei	36	45%
Other	0	0%

Total no of respondents	80
Total no of responses	80

### B4-1 Highest level of education of respondent

Answer	No.	% of total
None	2	3%
Attended primary	15	19%
Completed primary	22	28%
Attended secondary	32	40%
Completed secondary	6	8%
Other (specify)	3	4%

'Other' specified	No.	% of 'other'
Tertiary	3	100%

Total no of respondents	80
Total no of responses	80

**B5 Do you have any farm in another location? (record the total number of farms)**

Answer	No.	% of total
1	61	76%
2	17	21%
3	0	0%
4	1	1%
5	1	1%

Total no of respondents	80
Total no of responses	80

**B6 How many people live in your house?**

Answer	No.	% of total
0	2	3%
1	2	3%
2	7	9%
3	15	19%
4	19	24%
5	12	15%
6	13	16%
7	3	4%
8	4	5%
9	0	0%
10	1	1%
12	1	1%
15	1	1%

Total no of respondents	80
Total no of responses	80

**B7 Of these, how many are children 10 years and younger?**

Answer	No.	% of total
1	57	71%
2	13	16%
3	7	9%
4	2	3%
5	0	0%
6	1	1%

Total no of respondents	80
Total no of responses	80

**B8 Are you a member of any agricultural related community group?**

Answer	No.	% of total
No	28	35%
Yes	52	65%

Total no of respondents	80
Total no of responses	80

**SECTION C: FARM INFORMATION****C1 What type of farming do you do?**

Answer	No.	% of total
Only vegetables	22	28%
Fruits and vegetables	44	55%
Crops and livestock	14	18%

Total no of respondents	80
Total no of responses	80

**C2 What type of farming system do you practice?**

Answer	No.	% of total
Hand implements	5	6%
Animal traction	29	36%
Hand and animal	11	14%
Hand and tractor	1	1%
Animal and tractor	20	25%
Tractor	7	9%
All	7	9%

Total no of respondents	80
Total no of responses	80

**C3 What is the total area of your farm?**

Answer	No.	% of total
<1 acre	3	4%
1<5 acres	35	44%
5<10 acres	32	41%
10<15 acres	5	6%
15<20 acres	2	3%
20<25	1	1%
25<30	1	1%

Total no of respondents	80
Total no of responses	79

**C4 What is the nature of the tenure**

Answer	No.	% of total
Freehold	20	25%
Crown lease	0	0%
NLTB lease	16	20%
Sharecropping	6	8%
Sharecropping & freehold	2	3%
Sharecropping & NLTB	1	1%
Sharecropping & Mataqali	1	1%
Mataqali	33	41%
Other	1	1%

Total no of respondents	80
Total no of responses	80

**C5 How much of the total area of your farm are vegetables grown in?**

Answer	No.	% of total
<1 acre	5	6%
1<2 acres	12	15%
2<3 acres	13	17%
3<4 acres	15	19%
4<5 acres	13	17%
5<6 acres	11	14%
6<7 acres	5	6%
7<8 acres	1	1%
8<9 acres	0	0%
9<10	2	3%
20	1	1%

Total no of respondents	80
Total no of responses	78

**C6 What are your three main vegetable crops?**

Answer	No.	% of total
Tomato	44	18%
Eggplant	41	17%
None selected	27	11%
English cabbage	26	11%
Long bean	22	9%
Chinese cabbage	14	6%
Okra	14	6%
Cucumber	13	5%
Capsicum	10	4%
Cowpea	9	4%
French bean	4	2%
Bele	3	1%
Bean	2	1%
Corn	2	1%
Lettuce	2	1%
Pumpkin	2	1%
Watermelon	2	1%
Zucchini	2	1%
Peanut	1	0%

Total no of respondents	80
Total no of responses (80*3)	240

**C6-2 What time of year are the 3 major crops grown?**

Answer	Crop 1	Crop 2	Crop 3
January	46	51	31
February	45	47	38
March	53	57	43
April	67	70	44
May	82	82	51
June	106	95	66
July	109	107	70
August	117	111	74
September	106	96	63
October	81	70	42
November	52	56	39
December	47	52	27

**C7 Do you grow different varieties during different seasons?**

Answer	No.	% of total
No	60	77%
Yes	18	23%

Total no of respondents	80
Total no of responses	78

**C8 What is the typical cropping sequence for two of the fields where vegetables are grown?**

Answer	No.	% of total
All vegetable rotation	65	65%
Vegetables and root crops	6	6%
Vegetables and cereals	25	25%
No rotation	4	4%

Answer	No.	% of total
No fallow	64	64%
One fallow period	24	24%
Two fallow periods	12	12%

Total no of respondents	80
Total no of responses	100

#### SECTION D: SOIL HEALTH INFORMATION

D1 What is the typical soil series (or soil texture, type, if available)

Answer	No.	% of total
Don't know	56	70%
Sandy loam	19	24%
Loam soil	5	6%

Total no of respondents	80
Total no of responses	80

D2 What is the slope of your farm?

Answer	No.	% of total
Flat	71	85%
Mild slope (<15°)	13	15%
Steep (15°<30°)	0	0%
Other	0	0%

Total no of respondents	80
Total no of responses	84

D3 What of the following events has occurred in your farm in the past 5 years?)

Answer	No.	% of total
Flooding	84	88%
Land levelling	1	1%
Imported topsoil	0	0%
Improved drainage	10	11%

Total no of respondents	80
Total no of responses	95

D5 How do you till your land?

Answer	No.	% of total
Manual	29	14%
Animal	107	53%
Tractor	67	33%

Total no of respondents	80
Total no of responses	203

Answer	No.	% of total
Hoe	12	5%
Disc plough	81	35%
Harrow	83	35%
Scarifier	37	16%
Other	21	9%

Total no of respondents	80
Total no of responses	234

Answer	No.	% of total
0-5 cms	4	2%
6-10 cms	32	19%
11-15 cms	64	38%
16-20 cms	31	18%
21-25 cms	3	2%
26-30 cms	31	18%
More	5	3%

Total no of respondents	80
Total no of responses	170

Answer	No.	% of total
Before planting	158	51%
Mid-crop stage	71	23%
After harvest	82	26%

Total no of respondents	80
Total no of responses	311

**D6 How do you manage crop residue?**

Answer	No.	% of total
Remove from the field	35	40%
Incorporate into the soil	43	49%
Leave in the field	7	8%
Other	3	3%

Total no of respondents	80
Total no of responses	88

**SECTION E: PRODUCTION INFORMATION**

**E1 How many people work on your farm?**

Answer	No.	% of total
1	3	4%
2	33	42%
3	22	28%
4	14	18%
5	4	5%
6	3	4%

Total no of respondents	80
Total no of responses	79

**E1-1 Who does what activities on your farm?**

Answer	Men	%	Both	%	Women	%	No.
Weeding	28	35%	48	61%	3	4%	79
Planting	34	43%	45	56%	1	1%	80
Ploughing	74	94%	5	6%	0	0%	79
Pesticide application	72	92%	5	6%	1	1%	78
Fertiliser application	47	63%	26	35%	2	3%	75
Transport	68	92%	2	3%	4	5%	74
Administration	65	83%	10	13%	3	4%	78
Harvesting	23	29%	56	71%	0	0%	79
Selling of produce	51	65%	14	18%	14	18%	79
Buying of inputs	70	89%	8	10%	1	1%	79

	Family %	Family/ %	Family/ %	Family/ %	Family %	Casua %				
Answer		Casual	contract	Family /Perm						
Weeding	38	48%	27	34%	0	0%	1	1%	11	14%
Planting	42	53%	25	31%	0	0%	1	1%	11	14%
Ploughing	55	70%	11	14%	1	1%	1	1%	7	9%
Pesticide application	53	69%	12	16%	1	1%	0	0%	9	12%
Fertiliser application	48	64%	16	21%	0	0%	0	0%	9	12%
Transport	67	91%	2	3%	0	0%	0	0%	4	5%
Administration	78	99%	1	1%	0	0%	0	0%	0	0%
Harvesting	45	57%	23	29%	0	0%	1	1%	8	10%
Selling of produce	74	94%	2	3%	0	0%	0	0%	2	3%
Buying of inputs	79	100%	0	0%	0	0%	0	0%	0	0%

	Casual/ %	Contra %	Permane %	Family %	No.				
Answer	Contra ct	ct	nt	/mixed					
Weeding	1	1%	2	3%	0	0%	0	0%	80
Planting	1	1%	0	0%	0	0%	0	0%	80
Ploughing	1	1%	3	4%	0	0%	0	0%	79
Pesticide application	1	1%	0	0%	1	1%	0	0%	77
Fertiliser application	1	1%	0	0%	1	1%	0	0%	75
Transport	0	0%	1	1%	0	0%	0	0%	74
Administration	0	0%	0	0%	0	0%	0	0%	79
Harvesting	0	0%	0	0%	0	0%	2	3%	79
Selling of produce	0	0%	1	1%	0	0%	0	0%	79
Buying of inputs	0	0%	0	0%	0	0%	0	0%	79

**E2 What equipment do you use on your farm?**

Answer	Owned %	Hired %	Borrowed %	Do not %	No.				
Hand tractor	1	1%	0	0%	0	0%	79	99%	80
Wheel tractor	26	33%	28	35%	0	0%	26	33%	80
Plough	64	80%	7	9%	4	5%	5	6%	80
Spraying equipment	68	85%	1	1%	7	9%	4	5%	80
Irrigation equipment	29	36%	1	1%	2	3%	48	60%	80
Hand water pump	7	9%	0	0%	0	0%	73	91%	80
Motorized water pump	15	19%	0	0%	0	0%	64	81%	79
Plastic crates	26	33%	1	1%	0	0%	52	66%	79
Packing/storage shed	23	29%	0	0%	0	0%	56	71%	79
Transport	19	24%	17	22%	1	1%	42	53%	79

**E3 What is your source of water?**

Answer	No	% of total
Nearby river	64	81%
Borehold	2	3%
Well	4	5%
Other	9	11%

Total no of respondents	80
Total no of responses	79

**E3-1 How far is your source of water supply from the field (m)?**

Answer	No.	% of total
<=10	13	16%
10<50	22	28%
50<100	11	14%
100<200	11	14%
200<500	15	19%
500<1000	7	9%
>1000	1	1%

Total no of respondents	80
Total no of responses	80

**E5 Where do you source your seed from?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	%
	No.	%	No.	%	No.	%	No.	%		
Research station	1	10%	13	29%	3	11%	5	10%	22	17%
TTM	0	0%	1	2%	0	0%	0	0%	1	1%
Local stores	9	90%	23	51%	24	89%	43	90%	99	76%
Own saved seed	0	0%	7	16%	0	0%	0	0%	7	5%
Other farmers	0	0%	1	2%	0	0%	0	0%	1	1%
Other (specify)	0	0%	0	0%	0	0%	0	0%	0	0%
Total	10	100%	45	100%	27	100%	48	100%	130	100%

**E9 Do you use fertiliser on this crop? (capsicum, eggplant, English cabbage & tomatoes)**

Answer	No.	% of total
No	3	2%
Yes	118	98%

Total no of respondents	80
Total no of responses	121

**E9-1 Fertiliser type**

Answer	Tomato		Eggplant		English Cab		Total	
	No.	%	No.	%	No.	%	No.	%
Pig manure	0	0%	0	0%	0	0%	0	0%
Chicken manure	4	5%	5	6%	3	6%	12	6%
Compost	1	1%	1	1%	1	2%	3	1%
Urea	39	44%	33	43%	25	49%	97	45%
NPK	42	48%	35	45%	21	41%	98	45%
Liquid fertiliser	2	2%	3	4%	1	2%	6	3%

Total no of respondents	80			
Total no of responses	88	77	51	216

**E10 Do you use commercial pesticides on this crop (capsicum, eggplant, English cabbage & tomatoes)**

Answer	No.	% of total
No	9	8%
Yes	111	93%

Total no of respondents	80
Total no of responses	120

**E10-3 Do you use methods other than synthetic pesticides to control pests?**

Answer	No.	% of total
No	116	96%
Yes	5	4%

Total no of respondents	80
Total no of responses	121

**E11 How do you make pest management decisions?**

Answer	No.	% of total
Own experience	51	17%
Damage seen on crop	87	29%
Crop monitoring	68	23%
Extension staff recommendations	18	6%
Learned from other farmers	35	12%
Pesticide retailers recommendations	8	3%
Programme according to stage of crop	21	7%
Programme according to time of year	10	3%
Other	1	0%

Total no of respondents	80
Total no of responses	299

**E12 How do you water this crop?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
No irrigation	0	0%	2	3%	0	0%	2	3%	4	2%
Furrow	0	0%	3	5%	1	2%	1	1%	5	3%
Hose	1	8%	3	5%	4	10%	5	7%	13	7%
Bucket	2	17%	16	27%	12	29%	23	33%	53	29%
Watering Can	5	42%	16	27%	12	29%	22	31%	55	30%
Drip	0	0%	1	2%	0	0%	0	0%	1	1%
Sprinkler	1	8%	11	19%	7	17%	12	17%	31	17%
Other	3	25%	7	12%	5	12%	5	7%	20	11%

Total no of respondents	80
Total no of responses	12                      59                      41                      70                      182

**E14 What time of day do you harvest your produce?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Early morning	9	69%	31	45%	19	44%	20	27%	79	40%
Mid-morning	0	0%	10	14%	9	21%	19	26%	38	19%
Afternoon	2	15%	18	26%	10	23%	27	36%	57	29%
Evening	2	15%	10	14%	5	12%	8	11%	25	13%

Total no of respondents	80
Total no of responses	13                      69                      43                      74                      199

**E14-2 During harvesting, where do you keep your produce?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
On the ground	0	0%	14	26%	15	33%	14	22%	43	25%
Under a tree	5	50%	19	35%	10	22%	15	23%	49	28%
In the open	0	0%	6	11%	9	20%	6	9%	21	12%
Under a shelter	2	20%	9	17%	7	16%	12	18%	30	17%
In a shed	1	10%	5	9%	2	4%	11	17%	19	11%
Other	2	20%	1	2%	2	4%	7	11%	12	7%

Total no of respondents	80
Total no of responses	10                      54                      45                      65                      174

**E14-3 Do you grade or sort produce after harvest?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	4	40%	26	63%	19	73%	15	35%	64	53%
Yes	6	60%	15	37%	7	27%	28	65%	56	47%

Total no of respondents	80
Total no of responses	10                      41                      26                      43                      120

**E14-4 What criteria do you use to grade?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Size	6	40%	12	33%	7	47%	21	27%	46	32%
Colour	4	27%	2	6%	2	13%	16	20%	24	17%
Maturity	1	7%	8	22%	3	20%	13	16%	25	17%
Blemishes	4	27%	13	36%	3	20%	26	33%	46	32%
Weight	0	0%	0	0%	0	0%	0	0%	0	0%
Other	0	0%	1	3%	0	0%	3	4%	4	3%

Total no of respondents	80
Total no of responses	15                      36                      15                      79                      145

**E14-5 Do you wash produce after harvest?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	2	20%	34	83%	23	88%	32	74%	91	76%
Yes	8	80%	6	15%	3	12%	11	26%	28	23%

Total no of respondents	80
Total no of responses	10                      40                      26                      43                      119

**E14-6 What time of day is your produce collected or delivered?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Morning	2	20%	5	12%	4	15%	6	15%	17	15%
Afternoon	3	30%	20	49%	6	23%	13	33%	42	36%
Evening	0	0%	3	7%	7	27%	5	13%	15	13%
As soon as its ready	1	10%	7	17%	5	19%	5	13%	18	15%
Next day	4	40%	6	15%	4	15%	3	8%	17	15%
Longer than a day	0	0%	0	0%	0	0%	5	13%	5	4%
Other	0	0%	0	0%	0	0%	3	8%	3	3%

Total no of respondents	80
Total no of responses	10                      41                      26                      40                      117

**E14-7 What kind of packaging do you use?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Plastic crate	3	30%	3	7%	0	0%	4	10%	10	9%
Wooden crate	0	0%	0	0%	0	0%	37	93%	37	32%
Woven bag	2	20%	22	54%	11	42%	2	5%	37	32%
Plastic bag	0	0%	0	0%	0	0%	0	0%	0	0%
Other	5	50%	19	46%	15	58%	2	5%	41	35%

Total no of respondents	80
Total no of responses	10                      44                      26                      45                      125

'Other' specified	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Flour bags	1	20%	13	68%	9	60%	0	0%	23	56%
Onion bags	3	60%	0	0%	1	7%	1	50%	5	12%
Cartons	1	20%	0	0%	0	0%	1	50%	2	5%
Crest bags	0	0%	4	21%	4	27%	0	0%	8	20%
Sacks	0	0%	2	11%	0	0%	0	0%	2	5%
Packed in the trunk	0	0%	0	0%	1	7%	0	0%	1	2%

Total no of 'other' responses	5	19	15	2	41
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**E15 What are the main constraints in your vegetable production?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Low yield	1	4%	4	4%	0	0%	3	3%	8	3%
Lack of new marketable seed varieties	6	24%	11	12%	8	14%	15	15%	40	15%
Severe pest damage	4	16%	31	34%	19	33%	30	30%	84	31%
Poor soil fertility	1	4%	0	0%	0	0%	2	2%	3	1%
Lack of irrigation facility	2	8%	7	8%	6	11%	12	12%	27	10%
Lack of irrigation water	1	4%	6	7%	6	11%	5	5%	18	7%
Lack of capital to purchase farm tools	3	12%	11	12%	5	9%	10	10%	29	11%
Other	7	28%	20	22%	13	23%	23	23%	63	23%

Total no of respondents	80				
Total no of responses	25	90	57	100	272

'Other' specified	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Flooding/climate	3	43%	11	55%	8	62%	11	48%	33	52%
High cost of inputs/agrochemicals	2	29%	5	25%	2	15%	6	26%	15	24%
Lack of market/market price	1	14%	2	10%	1	8%	2	9%	6	10%
Marketing	0	0%	0	0%	1	8%	1	4%	2	3%
Distance of farm	1	14%	0	0%	0	0%	0	0%	1	2%
Price fluctuation	0	0%	1	5%	0	0%	0	0%	1	2%
Poor drainage	0	0%	1	5%	1	8%	0	0%	2	3%
Wilting	0	0%	0	0%	0	0%	1	4%	1	2%
Impure varieties	0	0%	0	0%	0	0%	1	4%	1	2%
Packaging materials	0	0%	0	0%	0	0%	1	4%	1	2%

Total no of 'other' responses	7	20	13	23	63
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**E15-1 Which one is the most important constraint?**

Answer	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Low yield	0	0%	0	0%	0	0%	0	0%	0	0%
Lack of marketable new seed varieties	1	11%	1	3%	1	4%	1	2%	4	3%
Severe pest damage	2	22%	22	55%	12	46%	23	55%	59	50%
Poor soil fertility	0	0%	0	0%	0	0%	1	2%	1	1%
Lack of irrigation facility	0	0%	2	5%	4	15%	4	10%	10	9%
Lack of irrigation water	0	0%	2	5%	2	8%	0	0%	4	3%
Lack of capital for farm tools	1	11%	2	5%	0	0%	0	0%	3	3%
Other	5	56%	11	28%	7	27%	13	31%	36	31%

Total no of respondents					
Total no of responses	9	40	26	42	117

'Other' specified	Capsicum		Eggplant		English Cab		Tomato		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Flooding/climate	3	43%	7	70%	4	57%	7	58%	21	58%
High cost of inputs/agrochemicals	2	29%	0	0%	0	0%	1	8%	3	8%
Lack of market/market price	1	14%	2	20%	1	14%	2	17%	6	17%
Marketing	0	0%	0	0%	1	14%	1	8%	2	6%
Distance of farm	1	14%	0	0%	0	0%	0	0%	1	3%
Price fluctuation	0	0%	0	0%	0	0%	0	0%	0	0%
Poor drainage	0	0%	1	10%	1	14%	0	0%	2	6%
Wilting	0	0%	0	0%	0	0%	0	0%	0	0%
Impure varieties	0	0%	0	0%	0	0%	0	0%	0	0%
Packaging materials	0	0%	0	0%	0	0%	1	8%	1	3%

Total no of 'other' responses	7	10	7	12	36
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## SECTION F: MARKETING INFORMATION

F1: What are the main markets for the three major crops (record as % of total crop marketed)

Answer	Export		Resort		Suva		Sigatoka		Nadi	
	No.	%	No.	%	No.	%	No.	%	No.	%
<=10%	1	6%	1	5%	0	0%	7	8%	4	21%
<=20%	2	11%	0	0%	3	3%	6	7%	6	32%
<=30%	6	33%	3	16%	5	5%	1	1%	2	11%
<=40%	0	0%	0	0%	0	0%	6	7%	0	0%
<=50%	7	39%	1	5%	11	11%	13	15%	0	0%
<=60%	0	0%	1	5%	9	9%	1	1%	0	0%
<=70%	0	0%	0	0%	6	6%	0	0%	0	0%
<=80%	0	0%	7	37%	12	12%	3	3%	0	0%
<=90%	0	0%	3	16%	15	14%	9	10%	3	16%
<=100%	2	11%	3	16%	43	41%	43	48%	4	21%

Total no of respondents	72
Total no of responses	18    1    19    1    104    1    89    1    19    1

Answer	Home		Other		Total	
	No.	%	No.	%	No.	%
<=10%	79	96%	4	12%	96	26%
<=20%	0	0%	7	21%	24	7%
<=30%	0	0%	0	0%	17	5%
<=40%	0	0%	1	3%	7	2%
<=50%	3	4%	1	3%	36	10%
<=60%	0	0%	0	0%	11	3%
<=70%	0	0%	0	0%	6	2%
<=80%	0	0%	3	9%	25	7%
<=90%	0	0%	1	3%	31	9%
<=100%	0	0%	16	48%	111	30%

Total no of respondents	
Total no of responses	82    1    33    364

F2: Who sells your produce to the market?

Answer	No.	%
Middleman	51	37%
Self	87	63%
Sold to vendor	1	1%

Total no of respondents	74
Total no of responses	139

**F4: Do prices increase/decrease during the year for each crop?**

Answer	Eggplant		English Cab		Tomato		All	
	High	Low	High	Low	High	Low	High	Low
January	10	16	16	1	30	1	95	36
February	13	16	21	1	33	2	114	38
March	18	10	21	1	34	1	112	26
April	18	5	14	5	18	5	88	28
May	20	10	8	10	13	12	72	62
June	24	16	3	20	6	30	65	115
July	21	19	0	25	3	38	52	134
August	12	21	2	23	1	40	39	131
September	12	19	6	19	0	36	40	114
October	12	15	6	13	10	19	53	77
November	11	18	6	7	19	8	71	55
December	7	18	10	3	19	5	65	48

**G CAPITAL AND SOCIOECONOMIC STATUS**

**G1-1 What is your total annual income?**

Answer	No.	%
\$0-1,000	7	9%
\$1,001-5,000	25	31%
\$5,001-15,000	39	49%
\$15,001-25,000	2	3%
\$25,000>	0	0%
Don't know	2	3%
Prefer not to say	5	6%

Total no of respondents	80
Total no of responses	80

**G1-1 Is vegetable production your main source of income?**

Answer	No.	% of total
No	23	29%
Yes	57	71%

Total no of respondents	80
Total no of responses	80

**G3 What other activities do you do to earn an income?**

Answer	No.	% of total
Livestock	17	21%
Poultry	6	8%
Fruit	35	44%
Sugarcane	0	0%
Employment on another farm	1	1%
Middleman or market vendor	0	0%
Other	29	36%

Total no of respondents	80
Total no of responses	80

'Other' specified	No.	% of total
Root crops	12	41%
Other crops	5	17%
Fish	1	3%
Tobacco/small business	4	14%
None	7	24%
Total no of 'other' responses	29	



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