

**RAPID ECONOMIC FEASIBILITY STUDY IN GUATEMALA:  
Cardamom | Cinnamon | Macadamia Nut | Nutmeg**

**Final Report**

**May**

**2014**



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Commissioned and Funded by

**Catholic Relief Services**

Guatemala

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# 1. LIST OF ACRONYMS

AGEXPORT	Asociación Guatemalteca de Exportadores
ANACAFE	Asociación Nacional del Café
AO	Absolute Options LLC
ASOBAGRI	Asociación Barillense de Agricultores
ASPIN	Indonesia Nutmeg Association
approx.	approximately
Cardegua	Asociación de Cardamomeros de Guatemala
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CONPRODA	Consejo de Producción Agrícola
CRS	Catholic Relief Services
DFAP	Development Food Aid Program
FAO	Food and Agriculture Organization
FEDECOVERA	Federación de Cooperativas de las Verapaces
f.o.b.	freight on board
GCNA	Grenada Cooperative Nutmeg Association
HA	hectare
HS	Harmonized Trade (Code)
IDEAS	Initiative for Developing Evidence and Advocating Solutions
IFAD	International Fund for Agricultural Development
IICA	International Institute for Cooperation on Agriculture
INAB	Instituto Nacional de Bosques
INE	Instituto Nacional de Estadística
LACRO	Latin America and Caribbean Regional Office
MAGA	Ministerio de Agricultura, Ganadería y Alimentación
MT	metric ton
N/A	not applicable
PRODEVER	Rural Development Program for Las Verapaces
SME	small and medium-sized enterprise
SITC	Standard International Trade Classification Code
SOCODEVI	Société de Coopération pour le Développement International
TA	technical assistance
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
WTO	World Trade Organization

## 2. INTRODUCTION

### 2.1 BACKGROUND

CRS is expanding its support for a wider range of high-value, environmentally friendly crops so that farmers can advance in their trajectory along the pathway to prosperity and achieve dignified incomes and employment. Crops and supply chains that will be given priority are those that are nonperishable with a long shelf life, that can be grown in agroforestry systems intercropped with other high-value or staple crops on small plots, that are easy to produce organically, and where value can be added in postharvest processing using simple, accessible, low-cost technologies.

CRS is cultivating relationships with a series of values-led food companies looking for more direct trade and sustainable relationships with smallholder producers in different countries where they source commodities. CRS has the opportunity to help companies like Costco, Clif Bar, Ben & Jerry's, and others fill this gap to overcome supply chain bottlenecks and assist with livelihoods development.

CRS now needs country-specific information on these crops, supply chain actors, and markets to move forward. Guatemala has been identified as a leader in the region for the existence of a critical mass of smallholders and supply chain actors producing and processing high-value spice and nut crops.

Spices have much potential as a profitable, low-risk, and sustainable crop for smallholders. Spices are less sensitive to storage conditions than most other agricultural commodities, have lower weight-to-value ratios, and can be stored for relatively long periods without a loss in freshness, quality, or value. In addition, growing and drying spices can be carried out profitably by relatively small farms without capital-intensive and high-technology equipment. With perennial tree or shrub crops, there is a waiting period for first harvest, which can vary from two to five years. Food security and intercropping strategies should be included to create a buffer during this period for smallholders.

### 2.2 OVERVIEW

This study assesses smallholder opportunities in the cardamom, cinnamon, macadamia, and nutmeg value chains. It provides

information on how each of these crops is currently integrated into existing farming systems and how they can be further developed to improve economic, environmental, and social outcomes in Guatemala.

Specifically, this study looks at how these crops are used for income generation and environmental regeneration through integration into farming and agroforestry systems and into marginal areas, such as along farm boundaries and waterways to provide ecosystem services including water filtration, soil fixation, and the reduction of wind erosion (see below: **Agroecological Suitability and Key Growing Regions**).

This study also assesses the potential of these crops to improve sustainable incomes through (see below: **Economic Feasibility Diagnostic**):

- Upstream linkages through sales of inputs, such as seeds, seedlings, and grafting materials
- Long-term investments in integration of these crops into existing farming and land management systems
- Downstream activities, such as postharvest and processing activities that can be reasonably undertaken by smallholders

Next, this study describes the challenges and opportunities facing smallholder producers in realizing the economic and ecological benefits of participating in competitive markets for cardamom, cinnamon, macadamia nuts, and nutmeg. It also identifies and maps organizations that can support smallholder participation in these supply chains in Guatemala, and it provides their contact information (see below: **Smallholder Challenges and Opportunities**).

Finally, this study describes opportunities for smallholders to add value to cardamom, cinnamon, macadamia nut, and nutmeg crops through postharvest activities, quality premiums, third-party certifications, aggregation, and other alternatives. It also identifies and maps postharvest-processing actors on the supply chain of each product and provides their contact information (see below: **Processing and Value-Addition Opportunities and Actors**).

Geographically, this study assesses the potential for these crops in the entire country, but also specifically references CRS target program areas in the highland departments of San Marcos, Quetzaltenango, and Totonicapán and the departments of the Oriente area: Zacapa, Chiquimula, Jalapa, and Santa Rosa.

### 3. AGROECOLOGICAL SUITABILITY AND KEY GROWING REGIONS

This section describes agroecological suitability requirements for cardamom, cinnamon, macadamia nut, and nutmeg crops, and it identifies key growing regions in Guatemala for these crops. This section also looks at the potential for environmental regeneration through integrating these crops into agroforestry systems and in marginal areas, such as along farm boundaries and waterways to provide ecosystem services such as water filtration, soil fixation, and the reduction of wind erosion.

**Table 1. Summary of Agroecological Suitability**

	CARDAMOM	CINNAMON	MACADAMIA	NUTMEG
<b>Ideal elevation/a</b>	760–1,400 meters	300–500	600–4,500 meters*	100–1,000 meters
<b>Actual elevation/a</b>	250–1,600 meters	300–1,000 meters (optimal)	600–4,500 meters	100–1,000 meters
<b>Ideal temp./a</b>	10–35°C	25–30°C	15–30°C	20–30°C
<b>Actual temp./a</b>	10–38°C	20–30°C	10–38°C	20–40°C
<b>Ideal rainfall/a</b>	1,000–3,500 mm	1,000–2,500 mm	1,500–2,000 mm	1,500–2,500 mm
<b>Actual rainfall/a</b>	1,000–5,000 mm	1,500–2,500 mm	1,500–6,000 mm	1,500–3,000 mm
<b>Soil type</b>	Loamy, well-drained soil Acidic (pH range of 4.2 to 6.8) Rich in humus and nitrogen Low to medium available phosphorus and potassium	Sandy loam mixed with humus Flourishes in a wide variety of soils	A wide range of soil types from open sands and lava rock soils to heavy clay soils Acidic (pH range of 5.5 to 6.5)	Neutral (pH near 0) Clay or sandy loam or laterite soils Well-drained soils
<b>Root system</b>	Shallow roots (approx. 40 cm). Most root systems have a radius of 50–75 cm. Because cardamom roots are shallow, they do not compete for nutrients with many shade trees.	Taproot with lateral roots systems are concentrated in top 50 cm of soil depth. Varies by type of soil.	Fine fibrous root “pad” with a taproot.	Shallow but extensive with one taproot and a spreading mat of lateral feeder roots branching into rootlets. Mat may extend beyond the spread of the stem branches and can measure as much as 3.5–5 meters from stem base.
<b>Special conditions</b>	Soil drainage requirements mean that cardamom is often grown on slopes. Requires well-distributed rainfall. Requires shade management or low growing temperature. Intolerant of dry spells, waterlogged soils and wind.	Soil nutrients and continuous moisture determine product quality.	Can be intercropped with coffee (90% of macadamia farms in Guatemala are also coffee farms). Intolerant of prolonged dry spells. Intolerant of high salt. Young tree intolerant of frost.	Can be intercropped with cocoa, banana, cloves, coconuts, fruits, root crops and vegetables. Intolerant of waterlogged soils. Shallow root system means tree is easily blown down.

Note: “Ideal” conditions are based on agronomic research recommendations; “actual” refers to the actual growing conditions in Guatemala.

\* Above 2,000 meters the tree will not produce fruit and can only be used for shading or other ecological purposes.

### 3.1 CARDAMOM GROWING CONDITIONS AND REGIONS

Cardamom is effectively grown at elevations from 250 to 1,600 meters above sea level, in temperatures that range from 10 to 35°C. The Asociación de Cardamomeros de Guatemala (Cardegua) recommends elevations of 760–1,400 meters, with 800–1,300 meters being ideal for Guatemalan production.<sup>1</sup> Optimal rainfall for cardamom is 1,000–3,500 mm per year, though it is grown in Guatemala in areas that receive up to 5,000 mm. The plant is intolerant of dry spells and requires well-distributed rainfall. Growing areas in Guatemala receive 170–200 days of rain per year.<sup>2</sup> The plant is also intolerant of strong sunlight and requires careful shade management of 40–60 percent,<sup>3</sup> though in Guatemala it is grown under lower shade, but at higher elevations with lower temperatures to compensate.<sup>4</sup>

Regionally, the department of Alta Verapaz accounts for approximately 70 percent of Guatemala’s production.<sup>5</sup> This department contains over 43,000 cardamom-producing farms (*fincas*).<sup>6</sup> Additional significant growing areas are located in Huehuetenango, Quiché, Baja Verapaz, and in mountainous areas of Izabal, although smaller levels of production are also present in 14 other departments (less than 100 farms). In San Marcos, cardamom production is concentrated in the municipalities of Tacaná and Nuevo Progreso; in Totonicapán, there is very limited production in the municipalities of Momostenango, Santa Lucía la Reforma, and San Bartolo. Given the plant’s intolerance of dry spells, much of the Guatemalan Oriente is not appropriate for cardamom production. In Zacapa, the plant is found in the municipalities of Gualán, Cabañas, and La Unión. In Chiquimula, cardamom is grown in very limited areas. In Santa Rosa, it is only found in a very small area of Cuilapa, while there is none in Jalapa.

Cardamom is a potentially high-value component of agroforestry systems, especially on marginal or steeply sloping terrain. Because of the plant’s drainage requirements and intolerance to waterlogged soils, cardamom is mainly grown on steep terrain.<sup>7</sup> Cardamom has a shallow root system,

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1 Cardegua (AO interview, September 2013).

2 Anandaraj, Muthuswamy, and M. R. Sudharshan. Soils, Plant Growth and Crop Production: Cardamom, Ginger and Turmeric. Indian Cardamom Research Institute.

3 “Cultivation Practices for Cardamom—*Elettaria Cardamomum Maton*.” Spices Board, Ministry of Commerce & Industry, India, January 2009.

4 Cardegua (AO interview, September 2013).

5 *The World Market for Cardamom: Market Survey #02*. USAID Acceso Project, Fintrac, November 2011.

6 *Número de Fincas Censales, Superficie Cultivada y Producción Obtenida de Cultivos Permanentes y Semipermanentes*. Instituto Nacional de Estadística (INE), Guatemala City, October 2004.

7 *Cardamom—Field Preparation and Sowing*. Sikkim Agrinet.

with most roots penetrating to a depth of approximately 40 cm. The root system is also relatively narrow, with most lateral roots within a radius of 50–75 cm.<sup>8</sup> Because roots are shallow, they do not compete for nutrients with some shade trees. However, this makes the plant wind intolerant.

### 3.2 CINNAMON GROWING CONDITIONS AND REGIONS

Cinnamon tolerates a wide range of climatic conditions, though it prefers hot and moist climates, which produce an optimal flavor. Although 300 to 500 meters are optimal,<sup>9</sup> it is grown at elevations of 300–1,000 meters, in temperatures 25–30°C. It grows best in well-distributed rainfall of 1,500–2,500 mm annually and is intolerant of prolonged dry spells. Cinnamon is optimally grown in nutrient-rich sandy loam, but can grow in a wide variety of soil conditions, including marginal areas with poor nutrients, though these conditions degrade the quality of output.<sup>10</sup> In nutrient-poor soils, fertilizers will eventually be required to maintain the quality of the crop.<sup>11</sup>

Although only rarely grown intensively (there are only two departments in Guatemala where more than 50 trees are reported), cinnamon trees are found in numerous sites throughout the country, usually on farm boundaries or other marginal land. Departments where the crop is found include extensive production in San Marcos and Alta Verapaz and much smaller production in Guatemala, Chimaltenango, Escuintla, Sololá, Quetzaltenango, Suchitupéquez, Retalhuleu, Huehuetenango, Baja Verapaz, Petén, Izabal, and Jutiapa. Cinnamon is produced on five farms with 20 trees each in Totonicapan. In the Oriente, cinnamon is grown on one farm in Zacapa, on one farm with approximately 200 trees in Jalapa, and three farms Santa Rosa. Cinnamon is not reported present in Chiquimula.

Cinnamon trees are generally perceived to consume high levels of water, making them inappropriate for certain types of forest regeneration. However, the hardiness of the tree makes it a good choice as a productive crop on marginal land, such as farm boundaries and along some water courses. Cinnamon has a taproot with lateral root systems concentrated in top 50 cm, although root depth and

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8 Nair Prabhakaran, K. P. *Agronomy and Economy of Black Pepper and Cardamom: The "King and "Queen of Spices."* London: Elsevier, 2011.

9 *Agronomy of Cinnamon.* University of Ruhuna, Faculty of Agriculture, Sri Lanka, 2012.

10 Thankamani, C. K., and K. Sivaraman. "Agronomy of Tree Spices—Clove, Nutmeg, Cinnamon and Allspice." *Journal of Spices & Aromatic Crops* 3(2): 105–123, National Research Center for Spices, India, 1994.

11 *Agronomy of Cinnamon.* University of Ruhuna, Faculty of Agriculture, Sri Lanka, 2012.



**Figure 1. Cinnamon trees**

concentration vary with soil type.<sup>12</sup> As such, it can be intercropped with some types of plants, such as coffee. Although rainfall and soil type determine the quality of the product, there is an active market for artisanal cinnamon in Guatemala, which does not require high quality, and as such, the tree could be considered as a productive addition to agroforestry systems, even in areas where growing conditions are less than optimal.

### **3.3 MACADAMIA GROWING CONDITIONS AND REGIONS**

Although macadamia originated in low-elevation, subtropical rainforests, the tree can thrive in a wide range of moisture and soil conditions. Due to the strong expansion of marketing opportunities, the crop has been introduced into a variety of conditions in Guatemala, some of which may be considered suboptimal. Macadamia trees grow at elevations of 600–4,500 meters and temperatures of 10–30°C.<sup>13</sup> Optimal rainfall for the crop is 1,500–2,000 mm annually, though it is grown in Guatemala in areas with 1,000–6,000 mm.<sup>14</sup> The tree grows

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12 Malavipathirana, I., and S. Subasinghe. *Assessment of root growth pattern of Cinnamon (Cinnamomum verum Presl)*. Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka, 2004.

13 *Macadamia in the Orchard*. Australian Macadamia Society, 2012.

14 *Ibid.*; Lawrence Gottschamer, Manager, Valhalla Experimental Station and Macadamia Farm, (AO interview, September 2013).

in wide range of soil types, from open sands and lava rock soils to heavy clay soils, though it is intolerant of nutrition-poor soil, which reduces production.<sup>15</sup> It has a fine fibrous root “pad” surrounding the taproot. Limitations to planting sites include intolerance to high salt and intolerance to frost by young trees. It intercrops well with coffee, and 90 percent of Guatemalan macadamia farms are also coffee farms.

Approximately 350 farms in Guatemala produce macadamias, with a total population of over 1.2 million trees.<sup>16</sup> The largest areas planted with macadamia are located in the department of Quetzaltenango, where over 1,400 *manzanas* are under cultivation.<sup>17</sup> Additional key macadamia growing areas in Guatemala are located in the departments of Guatemala, El Progreso, Sacatepéquez, Chimaltenango, Suchitepéquez, Retalhuleu, San Marcos, Huehuetenango, Baja Verapaz, Alta Verapaz, Zacapa, and Jutiapa. In San Marcos, the largest populations of macadamia are located in the municipalities of San Pablo, with over 4,000 trees, and Nuevo Progreso, where there are more than 150 trees, with additional groves in Concepción Tutuapa, Tacaná, and El Tumbador. The municipalities of San Rafael Pie de La Cuesta, Sibinal, El Quetzal, and La Reforma have very limited macadamia populations. The department of Totonicapán has only very limited tree populations, all in the municipality of Momostenango.

In the Guatemalan Oriente, Zacapa is the most important macadamia producer. The municipality of Gualán is home to the largest macadamia populations, with over 180 trees on four farms. Additional populations in far more limited numbers are found in the municipalities of Estanzuela, Río Hondo, Usumatlán, and La Unión. In Chiquimula, very small populations of macadamia trees are found in the municipalities of Chiquimula, Camotán, Olopa, Esquipulas, Quezaltepeque, San Jacinto, and Ipala. In the department of Jalapa, the municipality of Mataquescuintla has five farms with macadamia populations. San Pedro Pinula also has a small population. Santa Rosa has only a small number of trees in the municipality of Cuilapa.

With proper shaping of the canopy, macadamia is a good choice as a productive shade tree for sunlight-intolerant crops such as coffee,

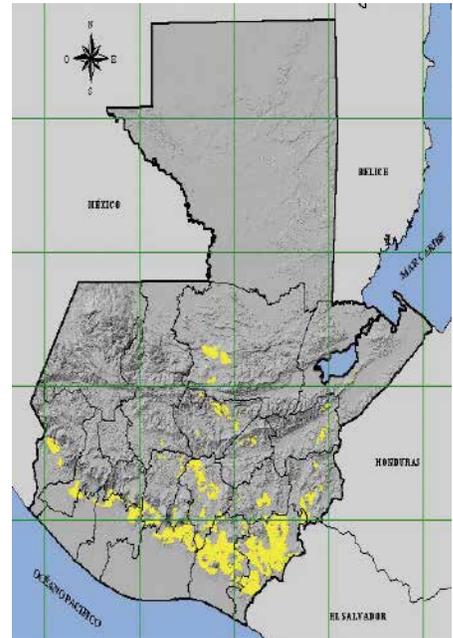
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<sup>15</sup> *Cultivo de Macadamia*. ANACAFE, August 2, 2004.

<sup>16</sup> Nottebohm, Carlos. “Guatemalan Macadamias” *Industria Guatemalteca de Macadamia S.A.*, 2012

<sup>17</sup> Número de Fincas Censales, Superficie Cultivada y Producción Obtenida de Cultivos Permanentes y Semi-permanentes. Instituto Nacional de Estadística (INE), Guatemala City, October 2004.

and potentially cardamom. Due to the wide disbursements of populations across diverse areas of the country, which put many populations within reach of technical support and marketing opportunities, and its adaptability to various climatic and soil conditions, macadamia is a good choice as a productive tree for integration into agroforestry systems. Given its long life, it can also play a role in environmental protection as a strong option for water-recharge-area protection and forestation, with its fine fibrous root pad offering good water filtration. Although planting on slopes complicates harvesting, the tree does well on steep terrain. The tree is also a powerful carbon absorber: 11 lb of macadamia absorbs 1 lb of carbon.<sup>18</sup> Finally, discarded or fallen macadamia nuts can be eaten raw, offering an excellent food supplement for diets deficient in folate, anti-oxidants, vitamins, and protein,<sup>19</sup> and hence contributing to the nutritional status of adjacent human populations.



**Figure 2. Macadamia growing areas**

### **3.4 NUTMEG GROWING CONDITIONS AND REGIONS**

Nutmeg trees ideally grow at altitudes of approximately 100–1,000 meters above sea level, in temperatures of 20–30°C. The tree ideally needs 1,500–2,500 mm of well-distributed rainfall annually, although in Latin America it has been grown in zones that receive up to 3,000 mm.<sup>20</sup> Nutmeg thrives in clay, sandy loam, or laterite soils, which need to be well-drained in order to avoid root rot. For this reason, trees are often planted on slight inclines. Nutmeg can be intercropped with crops like cocoa, banana, cloves, coconuts, fruits, root crops, and vegetables.

Nutmeg is among the most “artisanal” of crops in Guatemala, with no existing “defined” areas specializing in its production. It is found the lowlands south of Lake Izabal in the department of Izabal and in the

<sup>18</sup> Lawrence Gottschamer, Manager, Valhalla Experimental Station and Macadamia Farm (AO interview, September 2013).

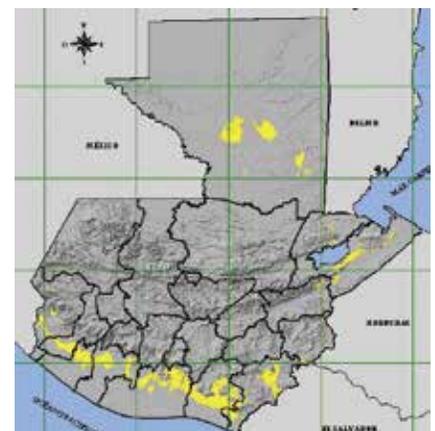
<sup>19</sup> *Macadamia Health Benefits*. Australian Macadamia Society, 2012.

<sup>20</sup> Thankamani, C. K., and K. Sivaraman “Agronomy of Tree Spices—Clove, Nutmeg, Cinnamon and Allspice.” *Journal of Spices & Aromatic Crops* 3(2): 105–123, National Research Center for Spices, India, 1994.

central Petén.<sup>21</sup> Given the growing conditions required by the tree, it could also be produced in additional areas, especially the “foothills” of 100–1,000 meters of Guatemala’s Pacific departments, some areas of Jutiapa and Zacapa, and very limited areas of Chiquimula.<sup>22</sup>

Potential areas specifically include almost 10,000 HA of the lower areas of San Marcos. In the Guatemalan Oriente, nutmeg could be grown on approximately 1,000 HA in the department of Zacapa near the frontier with Izabal, approximately 2,500 HA in the extreme south of the department of Chiquimula, and up to approximately 65,000 HA in the coastal foothills of Santa Rosa.<sup>23</sup> Even in these sites however, adequate soil types would need to be identified. Elevation and temperature in Totonicapán, and rainfall and temperature in Jalapa generally eliminate these areas for cultivation.

Nutmeg has a shallow but extensive root system, with one taproot and a spreading mat of lateral feeder roots. This mat may extend beyond the spread of the stem branches and can measure as much as 3.5–5 meters from the stem base. However, despite the large radius of the root system, its fragility makes the tree liable to be blown down in high winds.<sup>24</sup> Although its canopy makes the nutmeg tree a good choice for water filtration and useful as a shade crop, its wide root system means it may compete with other plants for nutrients and limits its usefulness in erosion control.



**Figure 3. Viable nutmeg growing areas**

21 Louis Mérida, Agronomist, Nestle’s (AO interview, September 2013).

22 Shirly Contreras, Information Analyst, Ministerio de Agricultura, Ganadería y Alimentación (MAGA) (AO interview, September 2013).

23 Consejo de Producción Agrícola (CONPRODA) (AO interview, September 2013).

24 Marcelle, Guido B. *Production, Handling and Processing of Nutmeg and Mace and Their Culinary Uses*. FAO, 1995.

**Table 2. Summary of Key Growing Regions**

	<b>CARDAMOM</b>	<b>CINNAMON</b>	<b>MACADAMIA</b>	<b>NUTMEG</b>
<b>Countrywide departments</b>	Guatemala, El Progreso, Chimaltenango, Escuintla, Santa Rosa, Totonicapán, Quetzaltenango, Suchitepéquez, Retalhuleu, San Marcos, Huehuetenango, Quiché, Baja Verapaz, Alta Verapaz, Petén, Izabal, Zacapa, Chiquimula, Jutiapa	Guatemala, Chimaltenango, Escuintla, Sololá, Quetzaltenango, Suchitepéquez, Retalhuleu, Huehuetenango, Baja Verapaz, Petén, Izabal, Jutiapa	Quetzaltenango, Guatemala, El Progreso, Sacatepéquez, Chimaltenango, Suchitepéquez, Retalhuleu, San Marcos, Huehuetenango, Baja Verapaz, Alta Verapaz, Zacapa, Jutiapa	“Foothills” of 100–1,000 meters in Guatemala’s Pacific departments, the lowlands south of Lake Izabal and Rio Dulce in the department of Izabal, central Petén, some areas of Jutiapa, Zacapa, and a small area in Chiquimula
<b>San Marcos</b>	Tacaná, Nuevo Progreso	Significant areas	San Pablo, Nuevo Progreso, Concepción Tutuapa, Tacaná, El Tumbador	Coastal foothills
<b>Totonicapan</b>	Momostenango, Santa Lucía la Reforma, San Bartolo	Limited	Momostenango	N/A
<b>Chiquimula</b>	Chiquimula, Jocotán, Camotán, Olopa, Quezaltepeque	N/A	Chiquimula, Camotán, Olopa, Esquipulas, Quezaltepeque, San Jacinto, Ipala	Extreme south
<b>Jalapa</b>	N/A	Limited	Mataquescuintla	N/A
<b>Santa Rosa</b>	Cuilapa	Limited	Cuilapa	Coastal foothills
<b>Zacapa</b>	Gualán, Cabañas, La Unión	Limited	Gualán, Estanzuela, Río Hondo, Usumatlán, La Unión	Small area near Izabal

## 4. ECONOMIC FEASIBILITY DIAGNOSTIC

This section presents a Smallholder Economic Feasibility Diagnostic for cardamom, cinnamon, macadamia nut, and nutmeg. The diagnostic includes a profitability analysis with net income projections using current average yields per hectare (HA) where applicable, production costs, current market prices, and potential markets for smallholders. This section specifically assesses the potential of these crops to improve incomes through:

- Upstream linkages through sales of inputs, such as seeds, seedlings, and grafting materials
- Long-term investments in integration of these crops into existing farming systems
- Downstream activities, such as postharvest and processing activities that can be reasonably undertaken by smallholders

**Table 3. Summary of Economic Feasibility Factors**

	CARDAMOM	CINNAMON	MACADAMIA	NUTMEG
<b>Propagation</b>	Suckers or seedlings	Seeds and grafting	Saplings or grafting	Seeds or grafting (10% male)
<b>Seasonality</b>	August or September-May	After rains (November)	Year-round (high after rains)	Year-round (March–July)
<b>Production delay</b>	2–3 years	7 years (2–3 years grafted)	7 years (3 years grafted)	7–9 years (2.5–3 years grafted)
<b>Productive life</b>	8–10 years	Up to 40–50 years	Up to 100 years	Up to 100 years (peak at 15–20 years)
<b>Yield per tree/a</b>	100–300 grams	5–14 kg	Approx. 22 kg (48.5 lb) in husk	14–22 kg green; 7–11 kg shelled, dried
<b>Actual planting density/b</b>	1,000–2,000/HA depending on terrain	N/A	Approx. 180 trees/HA	N/A
<b>Annual yield per HA/c</b>	140–480 kg processed capsules	N/A	3,500–4,000 kg in husk	N/A (approx. 8:1 nutmeg to mace)

Notes: a. Yields based on actual reported production per plant or tree of varieties available in Guatemala  
 b. Actual planting densities based on estimates of crops in Guatemala  
 c. Annual yields based on reported production per hectare of fields in Guatemala (actual yields vary widely with intercropping)

This section takes into account the risks to smallholders in realizing anticipated return on investments inherent in various income-generating opportunities associated with the production of cardamom, cinnamon, macadamia nuts, and nutmeg. As such, it makes reference to the Ansoff Matrix (see Table 4: **Ansoff Matrix**), which assumes that risks increase as producers move from existing

markets and products into new markets and new products. This is not only relevant as producers move into upstream, production, and downstream activities associated with these crops, but also as they, or others, consider investment into small and medium-sized enterprises (SMEs) in corollary processing and value-addition activities on these value chains (see below: **Processing and Value-Addition Opportunities and Actors**).

#### **4.1 CARDAMOM ECONOMIC FEASIBILITY**

Guatemala is the world's largest producer of cardamom, producing approximately 45 percent of world supplies, or an annual average of approximately 23,000–28,000 metric tons (MT) per year, virtually all of which is destined for export, particularly to the Middle East, especially Lebanon, Saudi Arabia, and the United Arab Emirates (UAE), where it is consumed as a condiment in traditional Arabic coffee.<sup>25</sup> Although production is focused on the department of Alta Verapaz, the perceived profitability of the crop has resulted in widely disbursed cultivation, further spurred by volatility in coffee prices and the cardamom plant's relative interchangeability with that crop (see above: **Cardamom Growing Conditions and Regions**).

Although crops that are mainly exported generally entail higher risks to producers than domestically consumed crops do, the relatively disbursed nature of the sector has resulted in good access to both technical assistance and marketing opportunities in potential production zones. However, these factors are offset by considerable variances in productivity and marketing. Factors that affect productivity include land type; intercropping patterns and planting density; fertilizer and pest control use; and labor costs during planting, harvesting, and processing. Marketing factors include postharvest activities, such as the time-sensitive and technically challenging drying process. This results in a relatively *medium risk* to producers who adopt cardamom in realizing anticipated return on investments.

The cardamom produced in Guatemala is genus *Elettaria*, also called green cardamom, or true cardamom (as opposed to genus *Amomom*, or black, white, or red cardamom.<sup>26</sup> Following a delay of two to three years after planting, cardamom plants have a productive life of 8–10 years, though many plantations replant after productivity begins to

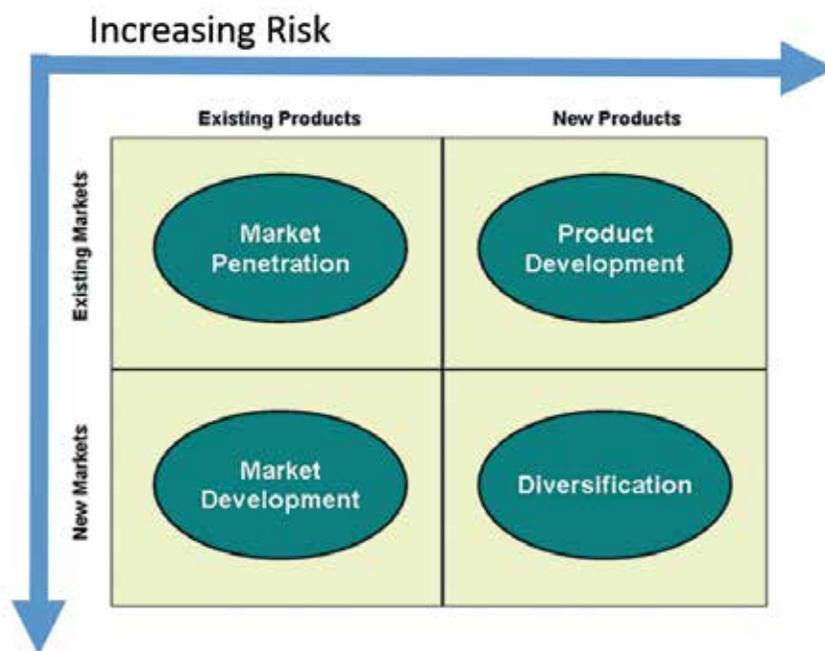
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<sup>25</sup> *The World Market for Cardamom: Market Survey #02*. USAID Acceso Project, Fintrac, November 2011.

<sup>26</sup> Guillermo Pop, Agronomist, Cardegua (AO interview, September 2013).

decline seven to eight seasons after planting.<sup>27</sup> Reported average yields for smallholders crops in Guatemala are 100–300 grams per plant. Maximum planting densities are 1,000–2,000 plants per HA depending on terrain, with sloping terrain bearing lower densities. Under maximum planting density, annual yields of up to approximately 750–1,500 kg per HA have been obtained under optimal conditions, while high-yielding varieties reach up to 2,000 kg (though these are

**Table 4. Ansof Matrix**



associated with India and are generally unavailable in Guatemala).<sup>28</sup> However, given that Guatemalan smallholders invariably intercrop cardamom, and often plant on marginal, especially sloping land, where maximum densities are lower, estimations of actual yields per hectare are much lower, ranging from 140 to 480 kg.<sup>29</sup>

Nursery production of cardamom seedlings is a relatively technically demanding and lengthy process. Seeds are selected from high-yielding plants, stored in their pods (“capsules”) until immediately

<sup>27</sup> *Ibid.*

<sup>28</sup> Korikanthimath, V. S. *Performance and Economics of Replanted Cardamom* Indian Institute of Spices Research. Cardamom Research Centre, India, 2000.

<sup>29</sup> Guillermo Pop, Agronomist, Cardegua (AO interview, September 2013).



**Figure 4. Guatemalan cardamom**

before planting, optimally treated with nitric and sulfuric acid to improve germination, washed, and then sundried. Over a period of six to seven months, the seeds are moved from the primary nursery to secondary nurseries. Given the high start-up investments, technically demanding handling, and the time-sensitive nature of production, a nursery operation is likely to be a relatively *high-risk* income-generation option for smallholder producers adopting cardamom. On the other hand, seedlings are available, and growers often opt to sell suckers derived from successful crops. These planting materials are available from various sources at prices of approximately Q5 to Q10 (\$0.65–\$1.28; \$ symbol denotes U.S. dollars throughout) per planting point (approximately five plants) (see below: **Smallholder Challenges and Opportunities**).<sup>30</sup>

Cardamom planting is labor intensive, due to soil and land preparation requirements. The plant is optimally planted in pits of 90 × 90 × 45 cm, which are prepared before the onset of the rainy season. Although, as noted, cardamom is almost universally intercropped, hence determining precise labor input requirements, growers estimate 30

<sup>30</sup> Exchange rate is calculated at \$1.00 = Q7.8.

to 60 days of labor to prepare 1 HA for cardamom planting, or Q600 to Q1,200 (\$76.92–\$153.85).<sup>31</sup> Additional costs and productivity determinants associated with cultivation include fertilizer and pesticide use and application, as well as miscellaneous costs, such as sacks.

Organic and inorganic fertilizers improve the productivity of cardamom plants, though many smallholders in Guatemala use no fertilizer on their crops. Cardamom is susceptible to a wide variety of pests and funguses, including aphids, caterpillars, mites, and white flies, as well as nematodes. Once planted, the plant is also susceptible to a variety of diseases, including *mosaic* and other viruses.<sup>32</sup> In Guatemala, recent harvests have suffered significant damage from infestation of *thrips* (“storm flies” or “thunder bugs”), a small insect that feeds on the contents of the cardamom pod. In response, in January 2013, the Asociación de Cardamomeros de Guatemala (Cardegua), in cooperation with the Asociación Guatemalteca de Exportadores (AGEXPORT), launched the campaign *Cardamomo Chabil Tzi Rubel Mu* (“Good Cardamom is Grown in the Shade”) to disseminate technical assistance on agronomic practices to improve output, including integrated control of pests.<sup>33</sup> As such, chemical control of pests and funguses is a potential cost for smallholder production, while disease is a significant risk. Reasonable estimates of the annual costs for fertilizers and pesticides are between zero and Q740 (\$0–\$95.00) for the equivalent of 1 HA.<sup>34</sup>

Harvesting and processing cardamom are also highly labor-intensive activities, integrated because of time sensitivity. During harvesting, the ripe pods are separated manually from the plants, following which they are processed (cleaned) by winnowing and washing. Processing follows harvesting immediately, as pods need to be dried within 24–36 hours of harvest to prevent deterioration through mold and other contaminants (see below: **Cardamom Processing and Value Addition**). A reasonable estimate of labor costs for harvesting and cleaning the equivalent of 1 HA is between Q900 and Q1,800 (\$115–\$230).

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31 Labor costs are estimated here at Q20 per day, or \$2.56.

32 *Cultivation Practices for Cardamom—Elettaria Cardamomun Maton*. Spices Board, Ministry of Commerce & Industry, India, January 2009.

33 *Ministerio de Agricultura Reconoce la Importancia de la Campaña para Mejorar la Calidad del Cardamomo Guatemalteco*. AGEXPORT Hoy, August 13, 2013.

34 Guillermo Pop, Agronomist, Cardegua (AO interview, September 2013).

**Table 5. Cost of Production for Cardamom (per HA)**

INPUTS (Q)	LOW	MED. LOW	MED. HIGH	HIGH
Planting materials	1,750	2,000	4,000	5,000
Planting (labor)	600	600	1,200	1,200
<b>TOTAL INITIAL COSTS</b>	<b>2,350</b>	<b>2,600</b>	<b>5,200</b>	<b>6,200</b>
Fertilizer	-	100	200	300
Fertilizer application (labor)	-	40	80	120
Pesticides	-	120	160	200
Pesticide application (labor)	-	40	80	120
Harvesting (labor)	600	600	1,200	1,200
Cleaning (labor)	300	300	600	600
Misc. costs (sacks, shovels)	100	100	200	200
<b>TOTAL SEASONAL COSTS</b>	<b>1,000</b>	<b>1,300</b>	<b>2,520</b>	<b>2,740</b>
<b>OUTPUTS (kg)</b>	<b>140</b>	<b>260</b>	<b>360</b>	<b>480</b>
<b>COST OF PRODUCTION (Q/kg)</b>	<b>7.14</b>	<b>5.00</b>	<b>7.00</b>	<b>5.71</b>

Based on estimated planting densities and costs of planting materials, as well as labor, reasonable estimates of total initial costs for smallholder production of 1 HA of cardamom ranges from Q2,350 to 6,200 (\$301–\$794). Likewise, given estimated costs of fertilizer and pesticide and their associated labor costs, as well as harvesting and processing labor, and miscellaneous costs for sacks and planting equipment such as shovels, a reasonable estimate of total seasonal costs ranges from Q1,000 to Q2,740 (\$128–\$351) per HA to produce between 140 and 480 kg of cardamom once plants become productive in three years. The estimated cost of production is therefore between Q5 and Q7.14 (\$0.64–\$0.92) per kg of processed capsules.

The market for cardamom puts a premium on larger and greener seeds.<sup>35</sup> In Guatemala, output is graded as First (*Primera*), Second (*Segundo*), Third (*Tercera*), Yellows (*Amarillos*), Opens (*Abiertos*), and Gold (*Oro*).<sup>36</sup> Producers estimate average prices they receive at Q20–Q30 (\$2.56–\$3.85) per kg from intermediaries who buy processed and undried cardamom capsules.

<sup>35</sup> Luxnor, Larry. "The Cardamom Connection." *Saudi Aramco World*, March 1997.

<sup>36</sup> Cardegua.

**Table 6. Estimated Cash Flow from Cardamom (per HA)**

	LOW	MED. LOW	MED. HIGH	HIGH
<b>TOTAL INITIAL COSTS (Q)</b>	2,350	2,600	5,200	6,200
<b>SEASONAL INCOME (Q)</b>	2,800	5,200	10,800	14,400
<b>TOTAL SEASON COSTS (Q)</b>	1,000	1,300	2,520	2,740
<b>BALANCE</b>	<b>1,800</b>	<b>3,900</b>	<b>8,280</b>	<b>11,660</b>

Given these prices, a reasonable cash flow estimate for 1 HA of smallholder cardamom is a total initial cost of Q2,350–Q6,200 (\$301–\$791). This investment can generate an annual balance of Q1,800–Q11,660 (\$231–\$1,495) per HA in Years 3–10 once plants are productive.

#### 4.2 CINNAMON ECONOMIC FEASIBILITY

Guatemala runs a consistent trade deficit for crushed and ground cinnamon, indicating that domestic production does not meet domestic demand.<sup>37</sup> In a national census of farms (*fincas*), only 137 were found to have cinnamon, with a total of just 1,901 trees total producing 272 *quintales* (12,338 kg).<sup>38</sup> The crop is only very rarely grown intensively, and high concentrations of trees are found only in a few departments, such as Alta Verapaz, where 56 farms have 438 trees, and San Marcos where 25 farms have 896 trees.

**Table 7. Guatemala Cinnamon Trade Balance**

	2007	2008	2009	2010	2011	AVERAGE
<b>Exports (\$)</b>	29,238	23,039	99,010	177,577	156,813	97,135
<b>Imports (\$)</b>	766,472	742,875	855,468	953,484	1,450,045	953,669
<b>Balance (\$)</b>	<b>(737,234)</b>	<b>(719,836)</b>	<b>(756,458)</b>	<b>(775,907)</b>	<b>(1,293,232)</b>	<b>(856,533)</b>

Source: United Nations Commodity Trade Statistics Database

Interviews with major international spice distributors operating in Guatemala indicate that domestic production is too low and geographically disbursed, and too variable in quality, to offer a viable source for their operations.<sup>39</sup> On the other hand, the country has a thriving “artisanal” trade in domestically produced cinnamon, with the product widely available in local markets, grocery stores, and

<sup>37</sup> United Nations Commodity Trade Statistics Database.

<sup>38</sup> *Número de Fincas Censales, Superficie Cultivada y Producción Obtenida de Cultivos Permanentes y Semipermanentes*. Instituto Nacional de Estadística (INE), Guatemala City, October 2004. (1 quintale = 45.36 kg.)

<sup>39</sup> For example, Julia Ortiz, Analyst, Grupo Alza and Louis Mérida, Agronomist, Nestles (AO interviews, September 2013).

supermarkets. Because consumers perceive the freshly ground flavor as superior, or even use it in strips to flavor beverages such as *atol* and *horchata*, it is most commonly sold in the relatively unprocessed form of dried strips of bark (*baras*). Likewise, specialty ethnic markets import cinnamon in easily produced qualities.

The quality of cinnamon is largely determined by climatic and soil conditions. However, cinnamon is a hardy and tolerant crop, and once appropriate conditions are identified, the technical and input demands of the tree are relatively low, making it an easy crop to manage. Given its marketing options, and the relatively low technical demands of production and processing, cinnamon offers a relatively *low-risk* option for producers adopting the crop to realize anticipated returns on investment.

In major cinnamon-producing countries, such as Indonesia, China, Sri Lanka, Madagascar, and Vietnam, the planting density of cinnamon trees varies considerably.<sup>40</sup> The maximum traditionally used by cultivators in nonintensive systems where it is intercropped with food crops is 3,000 to 4,000 per HA,<sup>41</sup> but it can be as high as 7,000 in intensive systems.<sup>42</sup> However, in Guatemala, where cinnamon is cultivated by disbursed trees on marginal or unused land, maximum densities and hectare output are not relevant. Grafted cinnamon becomes productive 2–2.5 years following planting, which is indicated by the bark turning brown.<sup>43</sup> Over the 40- to 50-year productive life of the tree, producers in Guatemala anticipate production of 5–14 kg of cinnamon annually.

Nursery production techniques for cinnamon are relatively common to nursery operators who specialize in tree crops. Seeds are planted in raised nursery beds 1 meter wide, 20 cm apart in rows, in holes approximately 4 cm in diameter and 4–8 cm deep. The holes filled with sand or topsoil, and 7–10 seeds are sown in each hole and covered with a thin layer of soil. Nursery beds are shaded with polythene and watered daily. Seeds start to germinate within 15–20 days.<sup>44</sup> When the seedlings reach a height of about 12 cm, the shade is removed. After the seedlings are three to four months old, weaker ones are removed,

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40 George Badaro, Buyer, Mabruk S.A. (A0 interview, September 2013).

41 Cairns, Malcolm (ed.). "Voices from the Forest: Integrating Indigenous Knowledge Into Sustainable Upland Farming." *Resources for the Future*. Washington, DC, 2007.

42 *Agronomy of Cinnamon*. University of Ruhuna, Faculty of Agriculture. Sri Lanka, 2012.

43 *Sri Lanka Spices—Cinnamon*. Sri Lanka Spice Council, 2010.

44 *Ibid.*

leaving three to four healthier plants in each hole. Eight- to ten-month-old seedlings can be field-planted. Given the techniques employed, nursery production presents relatively *low risk* to operators in realizing anticipated return on investments. Cinnamon seedlings are occasionally available in Guatemala, at approximately Q30–Q50 (\$3.85–\$6.41) per tree.

Beyond the initial investment in planting materials, cinnamon cultivation has very low inputs and very low cost. Planting is in holes of approximately 30 cm × 30 cm × 30 cm, early in the rainy season, optimally filled with well-decomposed organic nutrients mixed with topsoil. Training of cinnamon plants by pruning is important to get straight sticks.

When plants are 1.5–2 years old, lower lateral branches and leaves that are 30 to 45 cm from ground level should be removed to facilitate upward growth of healthy shoots. Although cinnamon responds well to fertilizer, Guatemalan producers rarely use any fertilizers to enhance production.

Although harvesting and peeling are separate activities in intensive systems, in Guatemalan production, the harvesting is a simple task of removing the bark from the tree by machete, while preserving the tree core for future production.<sup>45</sup> Once removed, the bark is air dried for five to seven days, cut into suitable sizes for marketing, and packaged, usually by wrapping in plastic and tying. The packaging hence entails minimal costs of approximately Q5 (\$0.64).<sup>46</sup>

Most cinnamon cultivators market their own output, selling to local



**Figure 5. Guatemalan cinnamon**

45 "Tutorial para Cosechar la Canela." *Abichela*, November 2007.

46 For example, Manuel Diaz, owner, Finca la Ciencia, Sacatepequez (AO interview, September 2013).

markets at a wholesale price of Q80 (\$10.25) per lb.<sup>47</sup> Given estimated annual yields of 5–14 kg (11–30 lb) per tree, cinnamon producers can reasonably expect to derive annual income of Q875–Q2,395 (\$112–\$307) per tree after costs.

**Table 8. Estimated Cash Flow from Cinnamon (per tree)**

	LOW	HIGH
<b>INITIAL COST</b>	<b>30</b>	<b>50</b>
<b>Yield (kg)</b>	5	14
<b>Yield (lb)</b>	11	30
<b>Price per lb</b>	80	80
<b>TOTAL INCOME</b>	<b>880</b>	<b>2,400</b>
<b>Misc. cost (packaging)</b>	5	5
<b>BALANCE</b>	<b>875</b>	<b>2,395</b>



**Figure 6. Harvesting cinnamon**

Additional marketing opportunities exist in further disaggregation of output. For example, smaller packages of one to five *baras* are sold for Q1–Q5 (\$0.07–\$ 0.64) in most markets. Limited markets also exist in Guatemala for ground cinnamon.

Based on these estimates, a cinnamon cultivator can expect an initial cost of Q30–Q50 (\$3.85–\$6.81) per tree. Given estimated yield of 5–14 kg (11–30 lb) per tree, current market prices of Q80 (\$10.25) per lb, and miscellaneous costs of approximately Q5 (\$0.64) per tree for packaging, cultivators can expect a positive annual balance of Q880–Q2,400 (\$112–\$307) per tree once productive.

### **4.3 MACADAMIA ECONOMIC FEASIBILITY**

Guatemala produced 7,185 MT of macadamia nuts in 2012, a figure that is expected to increase to 8,080 MT by 2015, and 10,635 MT by 2022.<sup>48</sup> Over half of Guatemalan exports are sent to the United States. With three major buyers and processors located in Guatemala City, as well as available markets for lower quality product, and production spread across a large area of the country, producers have ample access to technical assistance and marketing

<sup>47</sup> For example, Susan Hernandez, Market Vender, Chiquimula (AO interview, September 2013).

<sup>48</sup> Nottebohm, Carlos. Guatemalan Macadamia. Industria Guatemalteca de Macadamia S.A., 2012.

opportunities. Once appropriate growing conditions are identified, including soils with adequate nutritional properties, the tree generally produces reliably with few inputs aside from planting and harvesting labor (though productivity can be greatly improved through appropriate inputs such as fertilizers and pruning). As such, macadamia presents relatively *low risk* to producers in realizing anticipated return on investments.

Although there are 10 distinct species of macadamia in commercial production, most Guatemalan trees are *Macadamia integrifolia*, which is preferred for its production of uniform nuts, and *Macadamia tetraphylla*, often used as a base for grafts due to its strong root system.<sup>49</sup> Production in Guatemala began with Hawaiian varieties of these species, but now consists mostly of local and Costa Rican varieties. The tree can be planted by sapling or by grafting, and it becomes productive after seven years with the first option or three years with the second. Planting densities in Guatemala range from 150 to 180 trees per HA, which produce approximately 3,500–4,000 kg of in-husk nuts annually.<sup>50</sup>

Macadamia seedlings are not technically demanding to grow, and most processes will be familiar to nursery operators who grow trees. The seedlings are grown in coarse sand, approximately 30-cm deep. Seeds are planted approximately one thumb-width apart, so that the suture line of the seed is facing downwards, are buried by a thin layer of sand (2–3 mm). Once the seeds germinate and have reached a minimum height of 5 cm, they are potted in larger bags. Alternatives to seedbeds are placing the seednut in hessian bags on a flat surface. The bags are kept moist, and once the seeds begin to germinate, they are transplanted from the bags into larger pots.<sup>51</sup> As such, nurseries present a relatively low-risk activity for producers in realizing anticipated return on investment. Macadamia seedlings and saplings for grafting are available from several sources in Guatemala for Q15–Q30 (\$1.92–\$3.85) (see below: **Smallholder Challenges and Opportunities**).

Macadamia planting entails somewhat high labor demands. Two to four months before transplantation, the sapling taproots are ideally pruned to encourage development of a compact root system. Precise spacing needs to be calculated according to the altitude where the

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49 "Cultivo de Macadamia" ANACAFE, August 2, 2004

50 Thomas Nottebohm, Manager, Industria Guatemalteca de Macadamia S.A. (AO interview, October 2013).

51 Nursery Operations. Agrimac International Enterprises.

tree will be grown. Saplings are transplanted into 40 × 40 × 40 inch holes, or grafted at recommended spacing. When placed in the hole, the bag is cut to separate the root ball that has formed, and at the same time, 3 oz of triple-phosphate fertilizer should be applied.<sup>52</sup> A realistic estimate of labor demand for planting is 30 to 60 days of labor to prepare 1 HA, or Q600–Q1,200 (\$76.92–153.85).<sup>53</sup>

Although many Guatemalan smallholder macadamia producers apply low levels of inputs, macadamia responds well to fertilizers, and they are required in nutrient-poor soils. The Asociación Nacional del Café (ANACAFE) recommends fertilization with urea and potassium, 25–50 grams per year per tree. Potassium fertilization is recommended in a 1:1 ratio with nitrogen from the first to the fifth year, with the sixth year varying from 1.25:1 to 1.50:1. Depending on pH conditions, calcium application may also be required, while the potassium and magnesium content of the soil may also necessitate dolomitic lime application<sup>54</sup> Appropriate pruning also improves production significantly.

The tree is susceptible to pests, including thrips and aphids, for which chemical control may be required. However, there is extensive research available on organic production of macadamia and integrated pest control techniques.<sup>55</sup> Technical support for organic macadamia production is available in Guatemala through several sources, including the Valhalla Experimental Station and Macadamia Farm (hereinafter, the Valhalla Farm and Research Station), located in Sacatepequez (see below: **Smallholder Challenges and Opportunities**).

Harvesting macadamia is relatively easy. All harvesting is by hand, with a typical capacity of 75–90 kg per person per day. In general, the nuts are collected after falling to the ground, with smaller operators



**Figure 7. Guatemalan macadamia**

<sup>52</sup> *Cultivo de Macadamia*. ANACAFE. August 2, 2004.

<sup>53</sup> Labor costs are estimated here at Q20 per day, or \$2.56.

<sup>54</sup> *Cultivo de Macadamia*. ANACAFE. August 2, 2004.

<sup>55</sup> "Organic Farming in the Tropics and Subtropics—Exemplary Description of 20 Crops: Macadamia Nuts" Naturland e.V., Germany, 2002.



**Figure 8. Guatemalan macadamia plantation**

harvesting at lower intervals, peaking following rainy seasons.<sup>56</sup> Additional costs include miscellaneous costs of bags and other packaging materials.

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<sup>56</sup> Thomas Nottebohm, Manager, Industria Guatemalteca de Macadamia S.A. (AO interview, October 2013).

**Table 9. Cost of Production for Macadamia (per HA)**

<b>SUPPLIES (Q)</b>	<b>LOW</b>	<b>MED. LOW</b>	<b>MED. HIGH</b>	<b>HIGH</b>
<b>Planting materials</b>	2,250	2,700	4,500	5,400
<b>Planting (labor)</b>	600	600	1,200	1,200
<b>Fertilizer</b>	-	100	200	300
<b>Fertilizer application (labor)</b>	-	40	80	120
<b>Pesticide</b>	-	100	200	300
<b>Pesticide application (labor)</b>	-	40	60	80
<b>TOTAL INITIAL COSTS</b>	<b>2,850</b>	<b>3,300</b>	<b>5,700</b>	<b>6,600</b>
<b>ANNUAL PREPRODUCTION COSTS</b>	<b>0</b>	<b>280</b>	<b>540</b>	<b>800</b>
<b>Fertilizer</b>	-	100	200	300
<b>Fertilizer application (labor)</b>	-	40	80	120
<b>Pesticides</b>	-	120	160	200
<b>Pesticide application (labor)</b>	-	40	80	120
<b>Harvesting (labor)</b>	600	600	1,200	1,200
<b>Misc. costs (sacks, fuel)</b>	100	100	200	200
<b>TOTAL SEASONAL COSTS</b>	<b>700</b>	<b>1,000</b>	<b>1,920</b>	<b>2,140</b>
<b>OUTPUTS (kg)</b>	<b>3,500</b>	<b>3,500</b>	<b>4,000</b>	<b>4,000</b>
<b>COST OF PRODUCTION (Q/kg)</b>	<b>0.20</b>	<b>0.29</b>	<b>0.48</b>	<b>0.54</b>

Given these estimates for planting material costs and densities, a realistic estimate of total start-up costs for 1 HA of smallholder macadamia production ranges from Q2,850 to Q6,600 (\$365–\$846). Subsequently, cultivators will incur recurring annual preproduction costs of Q0–Q800 (\$0–\$102) over three to seven years, depending on propagation method, with these costs varying according to fertilizer and pesticide use. Once production commences, a realistic estimate of total seasonal costs ranges from Q700 to Q2,140 (\$90–\$274) to produce 3,500–4,000 kg of macadamia. A realistic cost of production ranges from Q0.20 to Q0.54 (\$0.03–\$0.7) per kg of in-husk nuts.

Reported prices for a pound of in-husk macadamia have ranged from Q2.25 to Q 2.74 (\$0.29–\$0.35) (see below: **Smallholder Challenges and Opportunities**). However, a reasonable average price for in-husk macadamia is Q2.50 (\$0.32) per lb, or Q1.33 (\$0.17) per kg.<sup>57</sup>

<sup>57</sup> Thomas Nottebohm, Manager, Industria Guatemalteca de Macadamia S.A. (AO interview, October 2013).

**Table 10. Estimated Cash Flow from Macadamia (per HA)**

	LOW	MED. LOW	MED. HIGH	HIGH
<b>Output (kg)</b>	3,500	3,500	4,000	4,000
<b>Output (lb)</b>	7,700	7,700	8,800	8,800
<b>SEASONAL INCOME (Q)</b>	<b>19,250</b>	<b>19,250</b>	<b>22,000</b>	<b>22,000</b>
<b>TOTAL SEASON COSTS (Q)</b>	<b>700</b>	<b>1,000</b>	<b>1,920</b>	<b>2,140</b>
<b>BALANCE (Q)</b>	<b>18,550</b>	<b>18,250</b>	<b>20,080</b>	<b>19,860</b>

Based on production of 3,500–4,000 kg per HA, estimated seasonal income ranges from Q19,250 to Q22,000 (\$2,468–\$2,820). Seasonal costs range from Q700 to Q2,140 (\$90–\$274), resulting in an anticipated positive balance of Q18,550–Q20,080 (\$2,378–\$2,574) per HA once trees become productive.

#### 4.4 NUTMEG ECONOMIC FEASIBILITY

International markets for nutmeg and mace are dominated by Grenada and Indonesia, which have implemented a marketing cartel of the products for many years. In Central America, nutmeg is often associated with coastal regions (unsurprisingly, given its connection with the West Indies, it is a characteristic ingredient in the cuisine of these regions). However, although obscured by several sources that incorrectly conflate nutmeg and mace with cardamom (such as FAOSTAT, the Statistics Division of the FAO),<sup>58</sup> Guatemalan exports of nutmeg are very low. The value of five-year average exports are only approximately \$17,500, and the country has run a consistent trade deficit averaging approximately \$135,000 between 2007 and 2011.<sup>59</sup>

**Table 11. Guatemalan Nutmeg Trade Balance (in U.S. Dollars)**

	2007	2008	2009	2010	2011	AVERAGE
<b>Exports (\$)</b>	15,717	9,907	21,673	18,459	21,735	17,498
<b>Import (\$)</b>	94,149	128,490	116,012	162,794	257,320	151,753
<b>Balance (\$)</b>	<b>(78,432)</b>	<b>(118,583)</b>	<b>(94,339)</b>	<b>(144,335)</b>	<b>(235,585)</b>	<b>(134,255)</b>

Source: United Nations Commodity Trade Statistics Database

Interviews with major international spices distributors and buyers in Guatemala indicate that domestic production of nutmeg is far too

<sup>58</sup> Nutmeg, mace, and cardamom are often conflated in trade data because these products are classified under a single Standard International Trade Classification Code (SITC): SITC (3) 075.25. They are more appropriately referenced by their Harmonized Trade (HS) Codes: HS0908.10 for nutmeg and HS0908.20 for mace.

<sup>59</sup> United Nations Commodity Trade Statistics Database.

small and disaggregated for local sourcing.<sup>60</sup> However, the spice is frequently found in local markets and grocery stores in both whole nut and ground forms, and vendors report that there is strong demand for both (on the other hand, mace [*macis*], is relatively unknown). Likewise, some ethnic markets specializing in Latino foods import small quantities of nutmeg from the region, usually from Mexico.<sup>61</sup> Given the relatively unsaturated market for nutmeg, producers can find a ready market for their products, and most producers market their own output. Likewise, the tree is relatively technically undemanding to grow (in Grenada, nutmeg is referred to as “the lazy man’s crop”). However, production is extremely disbursed, and technical assistance in-country is virtually nonexistent. Also, the long production delay of seven to nine years until a tree becomes productive, and up to 20 before trees reach full productivity, renders nutmeg a *moderately risky* crop with regard to realizing anticipated return on investment.

There is no serious documentation to support estimations of tree yields, and yields vary greatly among trees, and among plantations or field locations. However, production of approximately 14–22 kg green nutmegs (7–11 kg shelled, dry nutmegs) is considered a well-producing tree. Even in Grenada, where nutmeg is the focus of considerable government attention, it is difficult to calculate yield per hectare since most fields are heavily intercropped, there are wide variations in the planting density of trees, and there are very few locations with a significant area of pure stand nutmeg.<sup>62</sup> In Guatemala, where production is extremely disbursed and nonintensive, per-hectare yields are essentially not relevant.

A tree from seedling usually “declares” (begins producing) in seven to nine years. Trees propagated vegetatively by *marcots* (grafts) may fruit in three years, though grafts are not available in Guatemala. Yields increase gradually, and at 20–30 years, trees peak at their maximum production level. They continue to bear up to 100 years and more. However, after 70–15 years, yields tend to decline.<sup>63</sup>



**Figure 9. Nutmeg plantation**

60 For example, Julia Ortiz, Analyst, Grupo Alza, and Louis Mérida, Agronomist, Nestles (AO interviews, September 2013).

61 For example, El Sol de Mexico, based in Chula Vista, CA.

62 Marcelle, Guido B. *Production, Handling and Processing of Nutmeg and Mace and Their Culinary Uses*. FAO, 1995.

63 Dilon, Daniel. *Nutmeg Processing and Marketing in Grenada*. FAO, 1994.



**Figure 10. Guatemalan nutmeg**

Nursery production of nutmeg seedlings is relatively simple, and most techniques required would be familiar to nursery operators who grow tree crops. The seeds are planted in shaded nurseries where selected seeds are sown 2.5–5 cm deep and 30 cm apart in boxes or well-prepared moistened nursery beds. Germination takes about one month or more. After two to three months, the plants average about 15 cm in height. They are then transferred to baskets or plastic perforated bags. At six months they can be transplanted, but usually they left for up to 12 or 24 months. However, despite the ease of production, the extremely limited market for nutmeg seedlings would make nursery operations a relatively *high-risk* activity in terms of realizing anticipated return on investment, in the absence of specific support for dissemination of planting materials. Likewise, nutmeg seedlings are essentially unavailable in Guatemala, and would need to be specially grown or sourced from agronomic research centers. The Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) in Costa Rica is the only source of nutmeg-planting material identified in Central America (see below: **Smallholder Challenges and Opportunities**).

Planting nutmeg is relatively undemanding. Seedlings are planted in holes approximately 60 cm deep and filled with soil mixed with composted manure, and the plant is staked with wooden posts. The young trees require shade, which is gradually reduced after the second year, and by the seventh year completely removed. At the first flowering

after four to seven years, male plants are destroyed leaving one female per planting site.

Nutmeg trees are not traditionally fertilized and rely solely on existing nutrients or fertilizer run off from intercrops. Likewise, the tree has few serious threats from pests, and mature trees are usually given minimal attention in this regard.<sup>64</sup>

As soon as fruits split or about to split, they are hand-picked from the trees. Fruits are opened by hand, and the mace is removed from the nut where it is attached to the base of the nut by cutting with a small, pointed knife. The nuts are dried until the kernel rattles in the shell.<sup>65</sup> During drying, nutmeg loses about 25 percent of its weight.

Most Guatemalan nutmeg cultivators market their own output, selling to local markets at a wholesale price of Q2 (\$0.26) per nut, or Q15 (\$1.92) per oz. Given estimated annual yields of 7–11 kg (245–385 oz) per tree of shelled and dried nutmeg, a nutmeg cultivator can reasonably expect to derive an annual income of Q3,675–Q5,775 (\$471–\$740) per tree.

**Table 12. Estimated Cash Flow from Nutmeg (per tree)**

	LOW	HIGH
<b>INITIAL COST (Q)</b>	<b>0</b>	<b>50</b>
<b>Output (kg)</b>	7	11
<b>Output (oz)</b>	245	385
<b>Price per oz (Q)</b>	15	15
<b>TOTAL INCOME (Q)</b>	<b>3,675</b>	<b>5,775</b>
<b>Cost (Q)</b>	50	50
<b>BALANCE (Q)</b>	<b>3,625</b>	<b>5,725</b>

Based on these estimates, a nutmeg cultivator can expect an initial cost of between virtually zero (in the case of planting material obtained for free) and Q50 (\$6.81) per tree (given typical costs of saplings in Guatemala). Given estimated yield of 7–11 kg (245–385 oz) per tree, current market prices of Q15 (\$1.92) per oz, and negligible annual miscellaneous production costs for packaging materials and tools estimated at approximately Q50 (\$6.41), cultivators can expect a positive annual balance of Q3,625–Q5,725 (\$464–\$734) per tree once productive.

64 Marcelle, Guido B. *Production, Handling and Processing of Nutmeg and Mace and Their Culinary Uses*. FAO, 1995.

65 *Nutmeg*. Export Agriculture Department. Sri Lanka, November 2010.

## 4.5 SUMMARY OF ESTIMATED CASH FLOWS IN U.S. DOLLARS

Table 13. Estimated Cash Flow for Cardamom (US\$/HA)

	LOW	MED. LOW	MED. HIGH	HIGH
TOTAL INITIAL COSTS (\$)	301	333	667	795
SEASONAL INCOME (\$)	359	667	1,385	1,846
TOTAL SEASON COSTS (\$)	128	167	323	351
BALANCE (\$)	231	500	1,062	1,495

Table 14. Estimated Cash Flow for Cinnamon (US\$/Tree)

	LOW	HIGH
INITIAL COST	30	50
Yield (kg)	5	14
Yield (lb)	11	30
Price per lb	80	80
TOTAL INCOME (\$)	112.82	307.69
Misc. cost (packaging) (\$)	0.64	0.64
BALANCE (\$)	112.18	307.05

Table 15. Estimated Cash for Macadamia (US\$/HA)

	LOW	MED. LOW	MED. HIGH	HIGH
Output (kg)	3,500	3,500	4,000	4,000
Output (lb)	7,700	7,700	8,800	8,800
SEASONAL INCOME (\$)	2,468	2,468	2,821	2,821
TOTAL SEASON COSTS (\$)	90	128	246	274
BALANCE (\$)	2,378	2,340	2,574	2,546

Table 16. Estimated Cash Flow for Nutmeg (US\$/Tree)

	LOW	HIGH
INITIAL COST (\$)	0.00	6.41
Output (kg)	7	11
Output (oz)	245	385
Price per oz (\$)	1.92	1.92
TOTAL INCOME (\$)	471.15	740.38
Cost (\$)	6.41	6.41
BALANCE (\$)	464.74	733.97

## 5. SMALLHOLDER CHALLENGES AND OPPORTUNITIES

This section describes challenges and opportunities to smallholder participation in competitive markets for cardamom, cinnamon, macadamia nut, and nutmeg, focusing on agronomic, processing, and marketing technical assistance (TA), and inputs, especially planting materials. It also identifies and maps organizations that can support smallholder participation into these value chains in Guatemala, interviewed over the course of this study, along with their contact information.

**Table 15 Summary of Smallholder-Related Organizations**

PRODUCT/ORGANIZATION NAME	CONTACT INFORMATION	LOCATION	SERVICES
<b>Cardamom</b>			
<b>Asociación de Cardamomeros de Guatemala (Cardegua)</b>	Tel: +502 7952-9800 Email: cardegua1@hotmail.com	Cobán	Agronomic TA Access to planting materials
<b>Asociación Barillense de Agricultores (ASOBAGRI)</b>	Tel: +502 7780-2063 Email: asobagri.barillas@yahoo.es	Huehuetenango	Agronomic TA Fair trade marketing
<b>Comercial Agrícola Magdalena S.A.</b>	Tel: +502 2476-4824/2476-2419 Email: camsa@grupocoban.com.gt	Cobán	Agronomic TA Access to planting materials
<b>Federación de Cooperativas de las Verapaces (FEDECOVERA)</b>	Tel: +502 7950-0741 Email: info@fedecovera.com	Cobán	Association Development
<b>Slow Food Foundation for Biodiversity</b>	Tel: +502 5385-6673 Email: asipoi@hotmail.com	Santa Cruz del Quiché	Ixcán Cardamom project
<b>Cinnamon</b>			
<b>Finca Sepamaj</b>	Tel: +502 7951-0500/5971-2006 Email: fincasepamaj@gmail.com	Cobán	Agronomic TA Access to planting materials
<b>Mountain Rose Herbs</b>	Tel: +1 (541) 741-7307 Email: customerservice@mountainroseherbs.com	Eugene, Oregon	Organic TA
<b>Macadamia</b>			
<b>Finca El Injertal</b>	Tel: +1 (800) 843-0482 Email: infor@royalcofee.com	Huehuetenango	Access to grafts
<b>Industria Guatemalteca de Macadamia S.A.</b>	Tel: +502 2386-5700 Email: ag@ag.com.gt	Guatemala City	Processing and marketing TA
<b>Los Andes Nature Reserve</b>	Tel: +502 2328-5931/2328-5900 Email: ofic@andescloudforest.org	Sacatepéquez	Organic TA
<b>Valhalla Farm and Research Station</b>	Tel: +502 5889-4925 Email: exvalhalla@gmail.com	Sacatepéquez	Agronomic TA on organic Access to planting materials
<b>Nutmeg</b>			
<b>Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)</b>	Tel: +506 2558-2000 Email: csepul@catie.ac.cr	Cartago, Costa Rica	Agronomic TA Access to planting materials
<b>Consejo de Producción Agrícola (CONPRODA)</b>	Tel: +502 2334-1048/2360-4425 Email: upie@maga.gov.gt	Guatemala City	Agronomic TA

## 5.1 CARDAMOM CHALLENGES AND OPPORTUNITIES

Despite the widespread nature of Guatemalan cardamom production, and although Guatemala is the world's leading producer of cardamom, many farmers who could potentially grow the crop stated that they lack the required agronomic knowledge for its adoption. Additional challenges to smallholder producers include access to high-yielding planting materials, access to drying facilities, and processing and marketing assistance.

Agronomic technical assistance (TA) and planting materials are available from several sources in the country, most notably the Asociación de Cardamomeros de Guatemala (Cardegua), a private-sector association of producers, headquartered in Cobán, Alta Verapaz. Cardegua has provided TA on cultivation and environmental management to growers through the Rural Development Program for Las Verapaces (PRODEVER) *funded by the International Fund for Agricultural Development (IFAD). The group also offers planting material through its nursery located in San Marcos, Alta Verapaz.*

Additional sources of agronomic TA and planting materials include smaller and less specialized associations, such as the Comercial Agrícola Magdalena S.A., also located in Cobán, and the Asociación Barillense de Agricultores (ASOBAGRI), located in Huehuetenango. Although ASOBAGRI is primarily a coffee cooperative, it also offers TA in similar crops, including cardamom, with a focus on organic production. The Ixcán Cardamom project, located in Santa Cruz del Quiché, and operated by the Italian Slow Food Foundation for Biodiversity, has supported the expansion of cardamom production into indigenous areas of the department of Quiché through dissemination of agronomic TA and association development.

Despite high the volume of production, a relatively large share of profit is accrued to intermediaries and a relatively small group of export companies. Access to drying and marketing TA is a major barrier to smallholders' retaining a larger share of revenue from the crop. One success has been the Federación de Cooperativas de las Verapaces (FEDECOVERA), which supports producer cooperatives in Alta Verapaz and Baja Verapaz. Since 2002, with support from the Société de Coopération pour le Développement International (SOCODEVI), FEDECOVERA has evolved into a significant cardamom exporter, and it provides organic production and marketing TA, organizational development, access to processing facilities, and other

business services to over 12,000 households.<sup>66</sup>

## 5.2 CINNAMON CHALLENGES AND OPPORTUNITIES

Given the low level of production and the highly disaggregated and widely dispersed nature of cinnamon production in Guatemala, it is unsurprising that there are virtually no formal sources of agronomic, processing, or marketing support available to potential producers, and that the most common source of TA is likely to be farmer-to-farmer knowledge transfers. This presents a unique challenge for producers of this crop. Given that the quality of output is largely determined by soil and climactic conditions, and the long delay before trees become productive (seven years, or two to three years in the case of grafts), agronomic TA is important in the planning phase of cinnamon cultivation, though this is slightly offset by the relatively low-quality demands of local markets. Similarly, processing TA is useful, but relatively available through farmer-to-farmer knowledge transfers.



Figure 11. Cardegua

High-quality planting material is virtually unavailable in Guatemala, and the most likely sources are small-scale nurseries. One potential source of high-quality planting material is the Finca Sepamaj, located in Cobán, Alta Verapaz, a relatively new company specialized in agroforestry. Finca Sepamaj develops nurseries for agroforestry products located in production zones, and could potentially produce cinnamon saplings for grafting.



Figure 12. FEDECOVERA

While marketing is relatively simple, with most Guatemalan cinnamon cultivators processing and packaging their own output “artisanally” in local markets, and export markets relatively available to producers that can achieve significant quantities through specialized “ethnic” distributors serving Latino consumers (see below: **Cinnamon Processing and Value Addition**), there is very limited support for access to more demanding markets. There are currently no broad-based producer organizations supporting Guatemalan cinnamon cultivation and marketing, and as noted, major international spice distributors do not source from the country due to the low level

<sup>66</sup> Moore, Fauzya. *Aid for Trade Case Story—Guatemala*. World Trade Organization (WTO), 2011.

of production and disaggregation of supply (see above: **Cinnamon Economic Feasibility**). Likewise, smaller specialty distributors source cinnamon from major producing countries and are not prepared to invest in limited markets in Latin America.

One exception is Mountain Rose Herbs, located in Eugene, Oregon, and established in 1987. This company is highly specialized in distribution of certified organic and sustainably grown spices, including cinnamon. Although their focus is on precontracted U.S.-based suppliers, they can offer TA in cinnamon production and marketing to producers that are prepared to follow rigorous sustainability plans in order to obtain organic certification from United States Department of Agriculture (USDA)-recognized certifiers.

Although AGEXPORT includes cinnamon in *baras* in the list of products it supports, the agency has no significant experience in promotion of cinnamon for domestic or export markets.

### **5.3 MACADAMIA CHALLENGES AND OPPORTUNITIES**

With macadamia production relatively widely disbursed in Guatemala and markets that are fairly accessible, and given the broad support for the crop available, cultivators face few challenges in accessing agronomic, processing, and marketing TA, or in obtaining planting materials. However, given the estimated total start-up costs for 1 HA of smallholder macadamia production, Q2,850–Q6,600 (\$365–\$846), and the delay in production of up to seven years (or three years in the case of grafts; see above: Macadamia Economic Feasibility), potential cultivators find that financing the introduction of the crop is difficult. Illustratively, coffee producers in the departments of Chiquimula and San Marcos, when asked if they had considered replacing banana with macadamia as a shade component in their coffee fields, replied that they were interested in doing so, but while they perceived the profitability as higher, they could not afford the costs of transitioning between banana and macadamia.<sup>67</sup>

Although no producer associations currently operate in Guatemala, agronomic TA is available from a variety of sources, including the Ministerio de Agricultura, Ganadería y Alimentación (MAGA), which has trained extensionists on staff. The Industria Guatemalteca de

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<sup>67</sup> Coffee producers, departments of Chiquimula and San Marcos (AO Interviews, September 2013).

Macadamia S.A., which works under the brand name Mayan Gold, and the Guatemalan National Coffee Association (ANACAFE), both based in Guatemala City, have published guides to macadamia production<sup>68</sup> and offer TA on production, processing, and marketing. Finca El Injertal, located in Huehuetenango, can provide high-yielding grafting materials. Specialized TA on organic production and access to organic seedlings and grafts are available from Los Andes Nature Reserve and the Valhalla Farm and Research Station, both located in Sacatepéquez. While current offers from Guatemala are low, importers in the United States, such as Specialty Products, which supplies Clif Bar, would be interested in partnering with producer organizations, if sufficient supply was identified.<sup>69</sup>

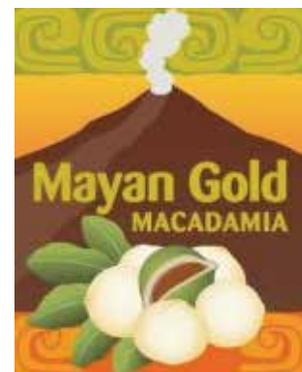


**Figure 13. Mountain Rose Herbs**

With interest rates at 24–32 percent, financing for tree cultivation through traditional sources is largely unavailable to Guatemalan cultivators.<sup>70</sup> Likewise, reforestation incentive programs implemented by the Instituto Nacional de Bosques (INAB) do not permit the introduction of productive trees in forestry management plans.<sup>71</sup> A useful innovation would be the development of specialized financial products aimed at the integration of appropriate productive crops into agroforestry systems, potentially through collaboration with existing microfinance institutions.

#### **5.4 NUTMEG CHALLENGES AND OPPORTUNITIES**

The Caribbean island nation of Grenada, in concert with Indonesia, has enjoyed an oligopoly arrangement with regard to international trade in nutmeg, which has kept prices high.<sup>72</sup> In Grenada, the development of the nutmeg sector is directed by the Grenada Cooperative Nutmeg Association (GCNA), an association of growers that dates back to the 1940s, while in Indonesia the sector is controlled by the Indonesia Nutmeg Association (ASPIN). Together,



**Figure 14. Mayan Gold**

68 *Cultivo de Macadamia*. ANACAFE. August 2, 2004.

69 Seth Novak, Specialty Products (AO Interviews, October 2013).

70 BanRural (AO interview, August 2013).

71 INAB (AO interview, September 2013).

72 *A Profile of Caribbean Agriculture in the 1900s*. International Institute for Cooperation on Agriculture (IICA), 1998.

these organizations supply about 98 percent of the world demand of approximately 10,000–12,000 MT annually (of which Grenada supplies about 25–30 percent, and Indonesia 65–70 percent.<sup>73</sup> However, the collapse of nutmeg trade agreements between the two countries in 1998, together with the effects of natural disasters (Hurricane Ivan in Grenada and the tsunami in Indonesia), have opened opportunities for new entrants in the nutmeg trade.

Despite this recently opened market opportunity, there is virtually no agronomic or processing TA support currently available to Guatemalan nutmeg cultivators, and access to planting materials is extremely limited. The Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) based in Cartago, Costa Rica, has introduced nutmeg for field tests and research at a site near Puerto Limon, and has disseminated materials to several sites in Costa Rica and the Dominican Republic.<sup>74</sup> However, this is the sole source of planting material identified in Central America. The Consejo de Producción Agrícola (CONPRODA), a unit of MAGA, potentially offers technical support on nutmeg production, but has yet to implement this in-country.

Processing and marketing TA is also nonexistent. There are no broad-based producer associations in Guatemala representing nutmeg cultivators, and neither major spice distributors nor specialized spice companies source from Guatemala, given the country's low levels and highly disaggregated production. However, there is unsupplied demand for the spice in Guatemala and Mexico, and ethnic spice distributors serving Latino communities may, however, represent a potential market for output, if significant levels of production could be achieved (see below: **Nutmeg Processing and Value Addition**).

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73 Charles, Reccia N. "Nutmeg—The Tradition of the Spice Isle and Strategic Management: A Match or a Misfit?" *Oxford business and Economics Conference 2008, Annual Conference Proceedings*. Association of Business and Economics Research, 2008.

74 "La Nuez Moscada es Cultivada en el País." *Hoy*, January 11, 2011.

## 6. PROCESSING AND VALUE-ADDITION OPPORTUNITIES AND ACTORS

This section describes opportunities for smallholders to add value to cardamom, cinnamon, macadamia nut, and nutmeg through postharvest activities, quality premiums, third-party certifications, aggregation, and other alternatives. It also identifies and maps postharvest-processing and value-addition actors on the supply chain of each product, along with their contact information.

**Table 16 Summary of Processing and Value-Addition Actors**

PRODUCT/ORGANIZATION NAME	CONTACT INFORMATION	LOCATION	SERVICES	
<b>Cardamom</b>				
<b>Cardex S.A.</b>	Tel: +502 2415-8400 Email: jgfernz.cardex@gmail.com	Guatemala City	Exporter (approx. 6,500 MT/year) Cardamom oil and oleoresin	
<b>Corban S.A.</b>	Tel: +502 5525-9605/7952-3381 Email: info@corbansa.com	Cobán	Exporter	
<b>Excard S.A.</b>	Tel: +502 6632-6749 Email: excard@excardsa.com		MT/year)	
<b>Exportadora Cardomino S.A.</b>	Tel: +502 2366-2063/2367-2193 Email: cardoexport@yahoo.com			
<b>Frontier Natural Products Co-op</b>	Tel: +1 (800) 669-3275 Email: customercare@frontiercoop.		am	
<b>MAYACERT S.A.</b>	Tel: +502 2463-3333 Email: mayacertcaribe@gmail.com			
<b>Unisource Holding Inc.</b>	Tel: +502 2427-5500 Email: contact@uhi.com.gt		Guatemala City	Exporters (approx. 5,000 MT/year)
<b>Cinnamon</b>				
<b>El Guapo</b>	Tel: +1 (323) 890-8900	Commerce, California	Distributor	
<b>El Sol de Mexico Spice Company</b>	Tel: +1 (619) 575-3016	Chula Vista, California	Distributor	
<b>Macadamia</b>				
<b>Alimentos Selectos (formerly, Nuez del Pacifico)</b>	Tel: +502 2328-1000 Email: info@alimentosselectos.com	Guatemala City	Processor Exporter	
<b>Camaco S.A.</b>	Tel: +502 2366-7641/2366-7642 Email: ag@ag.com.gt	Guatemala City	Processor Exporter	
<b>Industria Guatemalteca de Macadamia S.A.</b>	Tel: +502 2386-5700 Email: ag@ag.com.gt	Guatemala City	Processor Exporter	
<b>Valhalla Farm and Research Station</b>	Tel: +502 5889-4925 Email: exvalhalla@gmail.com	Sacatepequez	Processing TA	
<b>Nutmeg</b>				
<b>El Guapo</b>	Tel: +1 (323) 890-8900	Commerce, California	Distributor	
<b>El Sol de Mexico Spice Company</b>	Tel: +1 (619) 575-3016	Chula Vista, California	Distributor	
<b>Grupo Alza</b>	Tel: +502 5594-4689	Mixco	Distributor	

**Figure 15. Nutmeg in shells**

## 6.1 CARDAMOM PROCESSING AND VALUE ADDITION

As noted, cardamom is a highly export-oriented crop. Export markets for the crop put a price premium on flavor, green color, and large size of cardamom seeds. Although agronomic practices and planting materials largely determine productivity and size, the drying process is critical in determining color and flavor qualities and hence the price of the final product. However, given the technical complexity and associated costs of the drying process, few smallholders dry their own cardamom, preferring to sell it to middlemen that have access to drying facilities, or who sell it to a small group of exporters that dry it themselves. The moisture content of a fresh cardamom capsule is about 85 percent, which is reduced to approximately 10 percent in the dried product.<sup>75</sup> Once dried, the cardamom can be sorted and stored, allowing the dryer to realize pricing by quality. Hence, the primary option for smallholders in value addition lies in the drying process.

There is no clear indication as to when cardamom is fully dried, and the flavor constituents of cardamom are highly volatile and easily lost when subjected to direct heat and high temperature.<sup>76</sup> Although moisture meters can remove some of these variables,<sup>77</sup> the uncertain outcomes of the drying process, and the wide variations in cost, make it difficult to assess with certainty the cost versus benefits of adopting these systems directly. Given the demands of the drying process, a realistic option for smallholder cardamom producers is affiliation with associations and cooperatives that facilitate access to drying services, such as FEDECOVERA (see above: **Cardamom Challenges and Opportunities**).

Affiliation with drying services entails a wide range of cost and premium options (obviously dependent on the quality of the service), but also opens a wide range of marketing options to producers, including onward marketing services and group sales to exporters. Estimated costs of drying services range from Q3 to Q5 (\$0.38–\$0.64) per kg, while estimates of price premiums for drying are 80–150 percent.<sup>78</sup>

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75 Azam-Ali, S. "Cardamom Processing." *Practical Action*. United Kingdom, 2007.

76 Nair Prabhakaran, K. P. *Agronomy and Economy of Black Pepper and Cardamom: The "King and "Queen of Spices."* Elsevier, London, 2011.

77 Mande, Sanjay, and Anil Kumar, and V. V. N. Kishore. *A study of Large-Cardamom Curing Chambers in Sikkim*. Tata Energy Research Institute, New Delhi, 1999.

78 Cardamom producers in Alta Verapaz (AO interviews, September 2013).



**Figure 16. Cardamom dryer**

**Sun drying** entails spreading cardamom capsules on a concrete drying floor and using the natural heat from the sun to dry them. In Guatemala, some coffee-drying facilities often serve this purpose. This is the simplest and cheapest method, but it does not produce the highest quality product, as sunlight tends to bleach the green color.

**Solar drying** is cleaner and more controlled, but the intense heat can also compromise the green color.

**Wood fire dryers** entail use of special curing houses, using wood to provide heat. However, smoke can give the capsules an undesirable smoked flavor.

**Electric or gas dryers** are the most expensive of all options, but they produce the highest quality product.

**Humidity-controlled dryers** and **biomass gasifiers** are often used by larger exporters, but the cost of these options are beyond smallholder producers.

**Table 19. Estimated Cardamom Drying Premiums**

	LOW	MED. LOW	MED. HIGH	HIGH
<b>COST OF PRODUCTION (Q/kg)</b>	<b>7.14</b>	<b>5.00</b>	<b>7.00</b>	<b>5.71</b>
Drying services (Q/kg)	3	3	5	5
Cost increase of drying (%)	42	60	71	88
<b>COST OF PRODUCTION (DRIED) (Q/kg)</b>	<b>10.14</b>	<b>8.00</b>	<b>12.00</b>	<b>10.71</b>
Undried price (Q/kg)	20	20	30	30
Drying premium (%)	80	100	120	140
Drying premium (Q/kg)	16	20	36	42
Dried price (Q/kg)	36	40	66	72
Return on investment (%)	<b>533</b>	<b>667</b>	<b>720</b>	<b>840</b>

Based on these estimates of drying costs and premiums, and given the estimated costs of production, which range from Q5 to Q7.14 (\$0.64–\$0.92) per kg, the additional cost of drying can be 42–88 percent of the total cost of production. However, the drying process can add a substantial premium of Q16–Q42 (\$2.05–\$5.38) to the total price paid to the producer, or a return on investment of 533–840 percent.

Major cardamom exporters in Guatemala include Cardex S.A., Excard S.A., Exportadora Cardomino S.A., and Unisource Holding Inc., all based in Guatemala City, as well as Corban S.A. in Cobán. In addition to drying, packaging, and exporting whole cardamom, these companies also produce processed cardamom products, including essential oils and oleoresins. While a large proportion of smallholder output is ultimately marketed as a relatively source-undifferentiated product through these companies, there are also smaller specialized spice companies that offer premiums for sustainable and organic production. Frontier Natural Products Co-op, based in Norway, Iowa, is an example of a specialized spice company that is willing to contract with producers that follow sustainable production plans in order to obtain organic certification from a USDA-recognized certifier. Organic cardamom generally receives a 6–10 percent premium.<sup>79</sup> Certification is available from a number of sources in Guatemala, including MAYACERT S.A., which has offices in Guatemala City. However, the estimated cost of MAYACERT organic certification is approximately Q3,800 (\$500), variable according to the number of days and specific documentation required, providing another rationale for association development.

<sup>79</sup> *Meet Our Cardamom Grower*. Frontier Natural Products Co-op, Well Earth sourcing program, 2013.

Finally, it is notable that traditional competitors, such as India, as well as new entrants, such as Mexico and Columbia, have far outpaced Guatemala in areas such as research and export promotion. In response, Guatemalan producers have called for the creation of a “cardamom corridor” to enhance overall sector competitiveness, through “a joint effort between academia, the public sector, production, traders, and exporters.”<sup>80</sup>

## **6.2 CINNAMON PROCESSING AND VALUE ADDITION**

Given the low level and disaggregated nature of cinnamon production in Guatemala, it is unsurprising that there are virtually no formal companies specialized in value addition of Guatemalan cinnamon. Furthermore, given the Guatemalan preference for unprocessed cinnamon in strips (*baras*), there are very limited postharvest and value-addition activities available to producers.

Despite the local preference, there is a limited demand in local markets for ground cinnamon (though grinding reduces shelf life to approximately one year versus up to three years for cinnamon in strips). Ground cinnamon is irregularly sold in markets for Q2 (\$0.26) for packets of approximately 5 grams.<sup>81</sup> As with strips, most cinnamon cultivators market their own output. Cinnamon is ground in a basic hand grinder or automated coffee grinder, with little technical skill required.

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80 *Cardamom Growers Get organized*. Central America Data, October 13, 2013.

81 For example, Susan Hernandez, Market Vender, Chiquimula (AO interview, September 2013).

**Table 20. Estimated Cinnamon Grinding Value Added**

	LOW	HIGH
Output (kg/tree)	5	14
Output (grams/per tree)	5,000	14,000
Grinding premium (Q/gram)	0.12	0.12
<b>GRINDING VALUE ADDED (Q/tree)</b>	<b>600</b>	<b>1,680</b>



**Figure 17. Cinnamon in strips (baras)**

Given an estimated a wholesale price of Q80 (\$10.25) per lb for strips, or Q0.17 (\$0.02) per gram, versus a wholesale price of Q1.5 (\$0.19) for 5 milled grams, or Q0.3 (\$0.04) per gram, grinding cinnamon appears to result in a premium of Q0.12 (\$0.02) per gram, or approximately 70 percent. Given estimated annual output of 5–14 kg per tree, or 5,000–14,000 grams, this premium could represent annual value added of Q600–Q1,680 (\$76.92–\$215.38) per tree.

El Sol de Mexico Spice Company, based in Chula Vista, California, and El Guapo, based in Commerce, California, are illustrative of ethnic food distributorships serving the Latino community in the United States. Pending assessment of samples, these companies buy cinnamon against confirmed letters of credit in both ground and strip form from producers able to aggregate shipments in f.o.b. weight units of 100 lb.

### **6.3 MACADAMIA PROCESSING AND VALUE ADDITION**

Despite the significance of cultivation in Guatemala, the macadamia sector generally performs poorly in comparison with competitors, including Hawaii and Costa Rica, due to the unpredictable quality

of kernels.<sup>82</sup> However, this situation stems largely from agronomic practices of farmers, including low levels of fertilization and irrigation; and given high initial investments and the long productive life of trees, it is likely to remain a long-term problem. Although macadamia can be used in a wide variety of value-added products, including skin-care products and essential oils, postharvesting options available to cultivators are rather limited.

Once the nut is harvested, the primary task facing cultivators is dehusking. This process results in a reduction of approximately 45–55 percent of the net weight of the harvest, depending on moisture levels, with the upper end resulting from wetter conditions. Dehusked nuts obtain a value roughly twice that of in-husk nuts, but allow for the sorting of nuts resulting in prices toward the upper end of the price range. Many smallholders choose not to dehusk and instead sell their nuts in the husk to intermediaries with access to dehusking equipment. This equipment is available in-country for approximately \$5,000, including a model locally produced by Valhalla Farm and Research Station in Sacatepéquez.

Once dehusked, the nuts are sold to processors who undertake the shelling. Following shelling, the nuts are machine-graded by color and size. There are major macadamia processors, all located in Guatemala City, including Alimentos Selecto (formerly Nuez del Pacifico), Camaco S.A., and Industria Guatemalteca de Macadamia S.A. These processors own their own farms and also purchase from several hundred smaller producers around the country. A fourth processing unit operated by Abelino Yak buys and processes lower quantities of nuts for export exclusively to China.

Sorting dehusked nuts prior to sale to processors for shelling entails sorting discarding black nuts and “holed” nuts (damaged by borer worms). Water sorting to discard floating nuts is a further sorting operation, which generally removes approximately 2 percent of output.<sup>83</sup>

Although more common in Mexico than in Guatemala, there is a minor market for unshelled, dehusked, but undried macadamia for direct consumption that pays approximately Q10 per lb. Although this represents a price premium of about 45 percent over prices offered

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82 *Macadamia Nuts: Economic and Competitive Conditions Affecting the U.S. Industry*. U.S. International Trade Commission; Thomas Nottebohm, Manager, Industria Guatemalteca de Macadamia S.A. (AO interview, October 2013).

83 Thomas Nottebohm, Manager, Industria Guatemalteca de Macadamia S.A. (AO interview, October 2013).

by processors, the limited demand makes this a relatively insignificant opportunity for cultivators.

#### 6.4 NUTMEG PROCESSING AND VALUE ADDITION

Generally, nutmeg is internationally traded in the whole form, either shelled or unshelled. It is usually ground in the market of destination and re-exported either whole or in ground form.<sup>84</sup>

The commercial products of the tree are nutmegs, mace, their essential oils, extracted oleoresins, and nutmeg butter. Nutmeg butter is prepared by extracting nutmeg fats. It is, however, a very minor product, consumed mainly in the source countries. Only very small quantities are exported.<sup>85</sup> Nutmeg and mace account for the vast majority of trade.

Given the very low level and highly disaggregated nature of production in Guatemala, it is unsurprising that there are no companies specializing in nutmeg value addition. As with cinnamon, ethnic food distributorships serving the Latino community in the United States may buy whole or ground nutmeg against confirmed letters of credit from producers able to aggregate shipments in f.o.b. weight units of 100 lb.

Although most nutmeg is sold in whole nut form, with consumers milling or grading the nut prior to consumption, there is a limited market for milled nutmeg in local markets. The milled spice sells for Q2 (\$0.26) for packets of approximately 1 gram.<sup>86</sup> As with whole nuts, nutmeg cultivators usually market their own output in milled form, though one small company irregularly offers the product as part of a line of locally processed spices (though the packaging does not identify the name of the company). Nutmeg milling requires a sturdy hand or machine mill, though little technical skill is required.

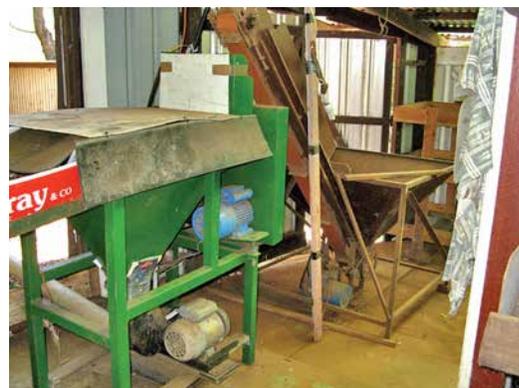


Figure 18. Macadamia dehusker

Table 21. Estimated Nutmeg Milling Value Added

	LOW	HIGH
Output (kg/tree)	7	11

84 Commodity Profile—Spices. United Nations Conference on Trade and Development (UNCTAD).

85 *Ibid.*

86 For example, Susan Hernandez, Market Vender, Chiquimula (AO interview, September 2013).

<b>Output (grams/per tree)</b>	7,000	11,000
<b>Milling premium (Q/gram)</b>	0.12	0.12
<b>GRINDING VALUE ADDED(Q/tree)</b>	<b>840</b>	<b>1,320</b>

Given an estimated a wholesale price of Q15 (\$1.92) per oz for nuts, or Q0.53 (\$0.07) per gram, versus a wholesale price of Q1.5 (\$0.19) per milled gram, milling nutmeg appears to result in a premium of Q0.12 (\$0.02) per gram, or approximately 70 percent. Given estimated annual output of 7–11 kg per tree, or 7,000–11,000 grams, this premium could represent annual value added of Q840–Q1,320 (\$108–\$169) per tree.



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