

Salvia hispanica: Meeting the rigorous post-harvest demands of rural farmers in Lempira with the introduction of a high value crop.



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ABSTRACT

Honduras is located in the Central American region, surrounded by the Atlantic and the Pacific Ocean. It has an estimated population of eight million inhabitants and it is well known for its agriculture, manufacturing, and tourism sectors. The department of Lempira is located in the mountainous and most remote terrains in the western sphere of the country. Home to the poorest population, it lacks access to plots and fields, generating a limited market and few development opportunities for small-scale producers. The poor infrastructure often translates into high transportation costs and excessive losses due to physical damage.

Chia, commercially grown for its seed due to its high nutritional value, is native to the Mesoamerican region. Although, in a global scale, countries such as Australia, Argentina, and Bolivia are popular Chia producers, other countries such as Mexico, Nicaragua, and Guatemala also produce the high value crop. In 2013, USAID-ACCESO, a four-year project operating in Honduras and funded by the U.S. Agency for International Development (USAID), introduced chia as a high value crop that could mitigate the post-harvest requirements that farmers in remote areas of Honduras meet.

The purpose of this thesis is to verify the viability of chia as a high value crop for small-scale farmers in the remote areas of Lempira, providing recommendations to the problem owners and chain actors in the country.

The interviews were adopted to create an understanding of the current infrastructure in Honduras and the existing situation that various chain actors and supporters of Honduras are facing. Furthermore, the survey was adopted to gather quantitative data, developing the farmer's demographics in Lempira.

Overall, the results from the interviews, conferring responses from the USAID-ACCESO team, indicate that the main problem farmers' face is the lack of adequate and/or maintained infrastructure in Lempira. This leads to other problems like access to input supplies, higher input and output costs, limited methods of transportation, access to financial institutions, and a limited market access. Additionally, the interview results indicate that chia had a successful test run in Honduras and that production will increase if market is guaranteed. Currently, buyers are proactively seeking the establishment of the chia chain. The survey results also demonstrate that most producers in Lempira are small scale farmers who live directly off their land with few to no means of transportation; interestingly showcasing that the furthest they live from the main city of the department of Lempira, Gracias, the higher the cost and risk to produce.

Compared to other high value crops introduced by USAID-ACCESO in the past, Chia meets the post-harvest requirements small-scale farmers in Honduras need. Correspondingly, using market-oriented crops can assure greater chain sustainability, creating a viable crop for farmers and safe supply for buyers.

LIST OF ABBREVIATIONS

GDP- Gross Domestic Product

DR CAFTA- Dominican Republic and Central American Free Trade Agreement

CariCom- Caribbean Commercial Block

USAID- United State Agency for International Development

IFAD- International Fund for Agriculture Development

USDA- United States Department of Agriculture

CBI- Centre for Promotion of Imports

CECOOPSEMEIN- Central de Cooperativas de Servicios Múltiples Exportación e Importación del Norte

PROHGSA- Procesadora Hondureña de Granos

TCC- The Chia Company

TERMINOLOGY

Agriculture practices: Activities conducted during chia productions such as land preparation, weeding, earthen up.

Benefit-cost ratio: is an indicator, used in the formal discipline of cost-benefit analysis, which attempts to summarize the overall value for money of a project or proposal.

Inflorescence: a flowering structure that consists of more than one flower and usually comprises distinct individual flowers

Lempira (L): Currency used in Honduras (L21.36 x \$1.00 as of 04/09/2014)

Post- harvest handling: The series of activities or process that occurs from harvesting to reach to the consumer, it covers, thrashing, cleaning, packaging, storage transport.

Quintal (qq): Unit of measurement used in Honduras (1QQ= 50kg)

Thrashing: beating of dried plant material to shaken seeds out.

1 INTRODUCTION

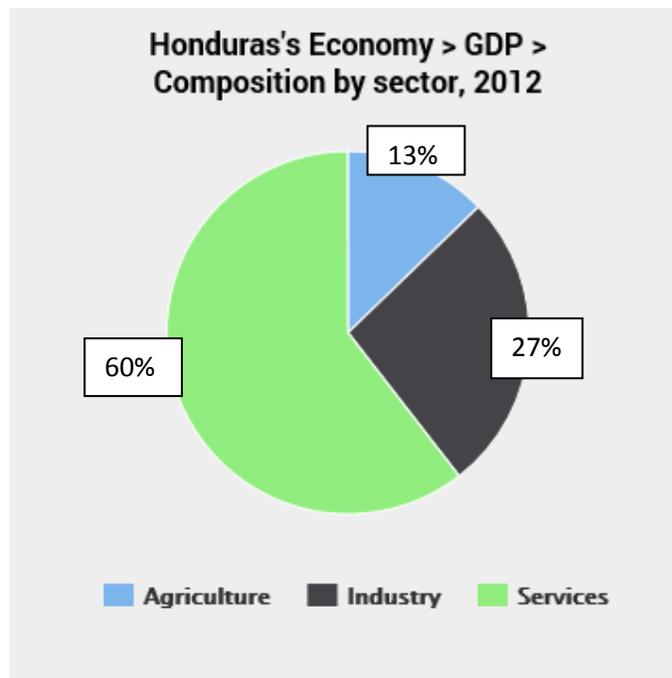
The first chapter is a general introduction of the thesis. The first four subsections of the chapter present the background information, research title and problem, and problem owner. The latter two sections will encompass the research objective and the research questions with respective sub questions.

1.1 BACKGROUND

Salvia hispanica, commonly known as chia, is a species of flowering plant in the mint family (Lamiaceae) that is commercially grown for its seed. Chia seed is obtained from the dried flowers of the plant and come in two main types: White chia and black chia, with the second being the more commonly produced variety. Native to central and southern Mexico and Northern Central America, chia seeds served as a primary staple food of the Aztec, Mayan, Incan and other indigenous peoples. Chia is supposed to derive from the Mayan word “strength”.

Honduras is located in the Central American region and is surrounded by the Atlantic Ocean (Caribbean Sea) and the Pacific Ocean through the Gulf of Fonseca. The estimated population is eight million inhabitants. Recently, the World Bank Group estimated Honduras’s GDP, as of 2012, to be \$18.4 billion, from which a \$2.4 billion corresponds from the agricultural industry. Figure 1 shows the composition of Honduras’s GDP by sector as of 2012.

Figure 1: Honduras’s Economy GDP (Source NationMaster 2014)



Honduras is well known for its agriculture, manufacturing, and tourism sectors. According to a result program done by IFAD (2012), the total non-manufactured exports in 2010 involved primary agricultural products for a total of US\$1.4 billion (51 per cent of total exports). Above all, agriculture provides the grains and other consumption goods for the population, primarily for lower-income groups, the largest segment of the population. Around 38 per cent of the economically active population is involved in agriculture.

After the DR-CAFTA was executed many export opportunities had arisen in the United States and Canada in varied sectors, such as automotive parts and services equipment, telecommunications, agricultural products, the textile industry, and the production of energy. Honduras is also part of many other free trade agreements through the Free Trade Agreement of Central American Integration with Canada, Chile, México, Taiwan, Colombia, The CariCom block, and recently as of 2013 the European Union.

Although strategically placed in the North American continent, added with favourable legislative trade agreements around 60% of Honduras's population is affected by poverty, the majority of which live in the rural areas. Poverty is dominant in hillside areas in the interior highlands of Honduras, which are home to about 75% of the rural population. The highest concentration of rural poverty is found in the western region, where Lempira is located. In the hillside regions Lempira, where small-scale farmers produce basic grains, slopes are often steep and difficult to cultivate and access. Most of the agricultural area is dedicated to the production of low-profit crops such as bananas, plantains, rice, maize and beans. This type of terrain is also extremely vulnerable to erosion and hardly accessible by vehicles. Lack of access to land and basic services are among the problems at the root of poverty in the country (IFAD 2012). Many development projects focus on this specific region of the country because of the facts before mentioned and the unique microclimate offered for agriculture production.

USAID-ACCESO, a four-year project funded by the United States Agency for International Development, is assisting more than 30,000 households in six departments in western Honduras, including Lempira. USAID-ACCESO is increasing sales and incomes by introducing basic production practices and market-driven programs for high-value cash crops, as well as expanding off-farm microenterprise and employment opportunities. There are six key components being implemented to enable economic development and nutrition improvements at the household level:

- Technical assistance and training to enhance the capacity of Honduras' poorest households in production, postharvest, management, and marketing skills.
- Market access focus, linking farmers to market opportunities.
- Rural financial services through existing rural financial intermediaries, village banks, commercial banks, and other service and input providers.
- Assistance in eliminating policy barriers that impede rural household access to market opportunities.
- Malnutrition prevention to enhance the capacity of rural households to improve utilization and consumption of food.
- Sound environmental and natural resource management. (Fintrac Inc. 2014).

1.2 RESEARCH PROBLEM

The department of Lempira is located in the mountainous and most remote terrains of western Honduras. The poorest population of Honduras lives in this department. The lack of access to rural plots and fields is limiting the market and development opportunities for small-scale producers. The poor infrastructure often translates into high transportation cost and excessive losses due to physical damage occurring during post-harvest transportation.

USAID-ACCESO first introduced crops like eggplant and string beans as a potential high value crop for small-scale farmers in this Region. Unfortunately, the problem of excessive losses due to physical damage during post-harvest transportation was identified and raised as a new problem. The project has recently identified Chia, commercially grown for its seed due to its nutrition, as a viable high value crop that meets the necessities of the small-scale farmers, solving the rigorous post-harvest requirements. Although native of the region, Chia is still considered a non-traditional crop and its value chain in Honduras is recent.

1.3 PROBLEM OWNER

USAID-ACCESO

USAID-ACCESO is working to lift rural households out of poverty and under nutrition through access to economic development opportunities and improved health and nutrition practices. USAID-ACCESO is increasing sales and incomes by introducing basic production practices and market-driven programs for high-value cash crops, as well as expanding off-farm microenterprise and employment opportunities.

1.4 OBJECTIVE OF RESEARCH

Examine the viability of Chia as a high value crop that meets the rigorous post-harvest demands rural farmers in the departments of Lempira and encounter.

1.5 RESEARCH QUESTIONS

Research Question 1

What constraints do small-scale farmers encounter when transporting their crops from the remote location their properties to the market and/or buyer?

Sub-Questions 1:

1. What different infrastructure options do small-scale farmers in Lempira have for the transportation of products?
2. What are the differences in costs for farmers in the remote areas of with more accessible farmers producing chia?
3. What advantages Chia offer small scale farmers over other value crops, like green bean and eggplants, in post-harvest in post-harvest requirements?
4. How does USAID-ACCESO help small-scale farmers in Lempira link to the market?

Research Question 2

What are the current Chia value chains for small scale farmers in rural Lempira, Honduras?

Sub-Questions 2:

1. What is the current market for Chia?
2. What are the functions of different actors in the Chia market and their relationship?
3. Why is Chia cultivation suitable for small scale farmers?
4. What are the different uses of Chia in the market?

1.6 RESEARCH STRATEGY

The research strategy was comprised of literature review, interviews with chain actors and supporters, and surveys carried out to small scale farmers. Table 1 depicts the research strategy used.

Table 1: Research Strategy

Research question Sub-question Key words	Source information	of	Research strategy
1. What constraints do small-scale farmers encounter when transporting their crops from the remote location their properties to the market and/or buyer?			
1.1 What are the different infrastructure options do small-scale farmers in Lempira have for the transportation products?	Farmers and Extension officer		Survey and interview
1.2 What are the differences in value share from farmers in the remote areas of Lempira with more accessible farmers producing chia?	Extension officer and farmers		interview and survey
1.3 What advantages does Chia offer small scale farmers over other value crops, like green bean and eggplants, in post-harvest in post-harvest requirements?	farmers and extension officers		Survey and interview.
1.4 How does USAID-ACCESO help small-scale farmers in Lempira link to the market?	Farmers, market officer and extension officers		Interview and Survey
2. What are the current Chia value chains for small scale farmers in Lempira, Honduras?			
2.1 What is the current market for Chia?	ACCESO documents, market journals, purchasing agent/exporter and ACCESO marketing officer		Desk study and interview
2.2 What are the functions of different actors in the Chia value chain and their relationship?	Production and post-harvest documents and extension officer		Desk study and interview
2.3 Why is Chia cultivation suitable for small scale farmers?	Market journals, farmer, extension officers, and purchasing agent		Desk study, survey, and interviews
2.4 What are the different uses of Chia in the market?	Market journals, marketing officer, and purchasing agent/ exporter		Desk study and interviews

1.7 THESIS OUTLINE

The report is divided into six chapters. The first chapter entails a chapter introduction, which includes the background information, problem statements, problem owner, objectives and research questions. The second chapter states the literature review, which includes the concepts of the crop's nutritional aspects, different uses, production and post-harvest management, and market. Chapter two also introduces the current states of rural infrastructure in Honduras, information regarding the current chia market, and the value chain concept. The third chapter includes research methodology, which comprises the research framework, study area, population size and sampling procedure, methods of data collection and methods of data analysis. The fourth chapter includes the findings and results of the survey and interviews regarding chia production and viability as an alternative high value crop for small-scale farmers in the department of Lempira. Correspondingly, the discussion is provided in the fourth chapter, which includes the reflection on the findings from the interviews and survey with that of the literature review. The conclusion regarding the results and discussion are included in the fifth chapter. Finally, recommendations to be given to USAID-ACCESO, farmers, and buyers are included in sixth and final chapter.

2 LITERATURE REVIEW

In the second chapter general information like, nutrition, usage, market, legislation, and production and post-harvest management of chia will be discoursed. Information of value chain concept, stakeholder analysis, and chain supporters and influencers will also be addressed. Moreover, the problems owners experience with past high value crops will be discussed.

2.1 CHIA NUTRITION AND HEALTH

Chia seeds have been regarded as super foods since the pre-Columbian era. In the re-composition of the Codex Mendoza done by Berdan and Anawalt (1996) chia seed constituted a significant portion of the Aztec diet and was used during extensive hunting trips because of the stamina it provided.

Chia is known to offer the highest combined plant source of omega-3, fibre and protein, alongside a range of vitamins, minerals and antioxidants. According to nutritional studies done by the USDA (2014) the dried seeds contain about 20% proteins, 35% oil and 25% dietary fibre. They are high in antioxidants and also offer a range of vitamins and minerals, including calcium, phosphorus, magnesium and zinc. A tablespoon of chia delivers 100% daily value of omega-3 ALA, 25% daily value of fibre and nearly 10% of calcium, magnesium and iron.

Due to its high fibre content chia helps lower cholesterol, improves intestinal health and regularity, it can also reduce the risk of colon cancer. The high omega-3 is essential for a cardiovascular system. According to The Heart Foundation (2008), Alpha-linoleic acid (ALA) help to lower cholesterol while maintaining proper artery function. Chia seeds have hydrophilic property; they swell up when soaked in water and form a gel-like substance. This gel substance slows the conversion of carbohydrates into sugar, thus releasing energy for longer periods of time. This property also helps stabilizes blood sugars and is beneficial for weight management. Furthermore, chia presents added nutritional benefit, as it is one of the few gluten free food source with high nutrition levels. Because of all these properties chia seeds are considered to be one of many “super-foods” (See Annex 1).

2.2 DIFFERENT USES

According to recent market insight carried by CBI (2013) chia seeds are used as a food supplement and are popular in vegetarian and gluten-free diets. Furthermore, they are used in the manufacturing industry as an ingredient in bread or as a topping for confectionary items (cakes, muffins, etc.), breakfast cereals, and seed and nut mixes (See Annex 2).

Chia seeds, as mentioned in the previous chapter, are mostly used as a nutritional/health supplement. They are consumed either in the whole seed form, oil extraction, or (limited to the North American market) as a powder made from the sprouted seeds. Although, according to recent events the Canadian and US government reported Salmonella outbreak in May 2014 that resulted in over 14 deaths involving sprouted chia seed powder. This event may change they range of products which chia seeds may be used in the North American market.

Athletes also use chia seeds as a natural form of energy and stamina enhancement. People with health issues use chia as a supplement to:

- Improve digestive system
- Regulate blood sugar for diabetics
- Improve cardiovascular health
- Healthy weight regulations
- Gluten intolerant diets

In their website, The Chia Brand Company states different culinary uses of chia like substitutes for jellying agents in jam and jellies. They also state that chia seeds can be used as thickeners for sauces and puddings as well. Recent research from Jamboonsri, et al. (2001) states that such highly unsaturated oil content like chia has is also a useful starting material for many renewable chemicals.

2.3 CHIA MARKET

According to the re-composition of the Codex Mendoza done by Berdan and Anawalt (1996) chia seeds and flour were so valuable to the Aztecs it was used as currency. According to the Australian chia company, in early 2012 bulk chia prices spiked from US\$4.00 per kg to US\$9.50 per kg due to poor harvests in South American producing countries. In a recent market brief done by USAID-ACCESSO (2014) a US importer confirmed this price spike and advised that, in general, suppliers should not offer more than US\$5,000 per MT (e.g. US\$5.00 per kg) if they hope to be competitive. In 2012, the global chia market amounted to only US\$70 million per year, but the market is expected to grow in the coming years due to increased consumer interest in healthier food alternatives.

In his recent article for Foodnavigator-USA (2013), Stephen Daniels states, the US market industry stakeholders is around 7,000 MTs per year, with a large share of this sold in pure seed form. Although, it is expected to exponentially grow within the US as a variety of products such as cereals, baked goods, and beverages will include chia as an ingredient. From August 2011 to September 2012, the Chia market grew by 239 percent and will reach US\$1.1 billion by 2020. While a relatively niche market until recently, large players such as Kellogg and Ready Pac Lunches are now introducing the seeds into their products, recently introducing a cereal bar and a ready to eat salad Pac containing chia in an attempt to profit from the growing health-conscious consumer in the US market.

Recent market insight report done by the CBI (2013) suggests three major market trends for chia:

- The first major market identified goes according to an increase in general consumer interest in healthy diet. Chia seeds healthy properties have made this product rise in demand. The most significant health benefit that drives the market is its high omega-3 content. The global Omega-3 market (foods, beverages and food supplements) was estimated at €5.6 billion in 2012, with a forecasted growth of 15-20% until 2015.
- The second major market trend identified was its popularity among vegetarian consumers. Being a good source of fibre, vitamins, and minerals has raised consumer

interest among vegetarians/vegans. In countries like Germany, Switzerland, and Italy reports suggest that around 9% of the population does not eat meat.

- The third and last major trend identified has been its inclusion into the gluten free diet. The gluten free aspect of the seed as created great interest in the gluten intolerant population. The global sales for gluten free foods are expected to reach \$3.4 billion in 2015.

Chia imports to Europe during the first half of 2013 were ten times larger than all of the 2012's shipments combined. Within Europe, the Netherlands, Germany, the United Kingdom, and Scandinavia are the largest buyers and consumers of chia.

2.4 LEGISLATION AND MARKET STANDARDS

Chia seed was considered a Novel Food under EU Novel Foods regulation No 258/97 due to a lack of history of consumption within the EU before 1997. The status of Chia seed changed in 2009 to become recognised and accepted as a novel ingredient that could be sold and consumed within the EU. This legislation approved the marketing of Chia seed and grounded Chia for inclusion in bread at a maximum of five percent (European Commission 2009).

According to EU legislation The Chia Co. now pursued approval under EU Novel Foods regulation No 258/97 to sell their packaged Chia within the EU and to expand the approved use of Chia as an ingredient in other food categories that commonly contain grains and seeds. It is requesting an "extension of use" for Chia seed within the EU for the following food product categories:

- 100% Packaged Chia seed
- Baked goods (muffins, cookies, crackers, biscuits)
- Breakfast cereal
- Fruit, nut, and seed mixes

Recent legislation in the EU approved in 2013 the use expansion of chia to:

- No more than 10% in baked products
- No more than 10% in cereals
- No more than 10% in fruit, seed, and nut mixes
- Pre-packaged chia seeds

The changes in legislation that occurred in 2009 and 2013 has changed Chia's market segment in Europe, from being traded as a speciality to a commodity item. Within the commodity segment the only difference could be made between conventional and non-legislative certified seeds (organic label, fair trade, etc.). (CBI 2013)

Chia seed has been approved for consumption as a food in the consumer market and food processing industry in N. America, Austral, Argentina, and Asia. Hence there is no specific legislation in the North American market, Honduran chia's target market. The raw seeds can be imported when the exporter has the necessary certifying standards. Although the US market allows for a wider range of use for Chia than allowed in EU, chia seeds in the North American market are still sold as a commodity item.

For both European and North American market the product quality standard is the same. According to USAID-ACCESO's (2014) market insight "at a minimum, chia shipments should at least have a 99.5 percent purity level (i.e. free of stems and foreign matter), but ideally this percentage should be at 99.7 percent. Additionally, chia seeds should be free from aflatoxins and mold."

2.5 PRODUCTION AND POST-HARVEST OF CHIA

About 24,000 metric tons of chia was produced in 2011, with approximately 80 percent originating from South America. Argentina, Bolivia, and Ecuador are the major producers in South America, while Guatemala, Nicaragua, Mexico are also significant producers. Outside Latin America, Australia is one of the largest chia producing countries. The Chia Company is Australia's largest producer by volume (approximately 3,000 MTs per year). Around 95 percent of Australia's production is exported to the US, Canada, and Europe. (USAID-ACCESO 2014) The US produces a small amount of chia in the Midwestern and Eastern parts of the country using a mutagenized long day variety. Production in these areas is limited by relatively short dry seasons and frosts that destroy seeds before reaching maturity (Jamboonsri, et al., 2011)

Growing Chia is latitude specific; it has to be grown in the range 10-20 degrees north or south of the Equator because of the required photoperiod and sensitivity to frost. Chia must be grown during the dry season, as the seed is hydrophilic, to mitigate the risk of crop losses and ensure that seeds are harvested at their peak maturity. If the chia seed gets rain on it, it will ruin the crop. South American and Australian chia becomes available starting August and September, while Central American chia is available starting January and February. Depending on the harvest, the US is able to meet its demand by purchasing from South America. However, during poor production seasons like in 2012 where Argentina suffered from losses due to drought and Bolivia lost 50 percent of its 2012 crop due to excess rainfall US importers will purchase from Mexico, whose late harvest season occurs in November and December (USAID-ACCESO 2014). México's geographical location (roughly 10-20 degrees latitude north) and diverse climatic regions it is able to have two growing season.

2.5.1 Large scale chia production Argentina and Australia

Large-scale production of Chia generated by two companies The Chia Company (TCC) and Benexia had found challenges when producing chia at large scale. The small size of the seed makes it very difficult during the harvesting and cleaning processes. Furthermore, specific machinery is needed for harvesting and cleaning chia seed, which in turn leads to a large initial investment.

Benexia, a Chile based omega3 Supplement Company produces its own chia seed in Argentina but also outsource much of their production to farmer organizations in Bolivia. Producing and sourcing Chia is a challenge that Benexia faces and in turn has relied on long-term relationships with small-scale farmer organizations. This in turn allows for greater social entrepreneurship and a diversification of crop production (See Annex 3). With the diversification of the locations of Chia crops, Benexia has been able to reduce the risk of harvest loss by adding new growers to our organization and by sharing the production know-how and technology needed to increase the long-term yield of the lots, to guarantee permanent quality and adequate environmental management (Benexia 2012)

In Australia, The Chia Company (TCC) has more than ten years in the industry beginning the first farms in Western Australia and now delivers chia seed and products to 36 countries. Similar to Benexia, TCC also experiences the same difficulties when it comes to extensive production and increasing production area. John Foss, founder and owner of The Chia Company personally searches for outsource production in Australia and Worldwide. In the company website Mr. Foss states his requirements when choosing the location for farms, searching for the right environmental conditions and looking for committed, passionate farmers. This has led the company to outsource its production to farmer organizations in Nicaragua, Kenya, and Tanzania (The Chia Co. 2013). Similar to Benexia as well TCC has been able to mitigate the risk of crop loss with production in different locations.

Furthermore, all outsourced farmers share a fair value profit. This ensures sustainable growth for the industry. This has allowed TCC to become the world's largest producers of premium quality chia. Mr. Foss believes this allows raising standards for chia across the globe by ensuring a consistent supply and stabilizing the price in the chia market year round.

2.5.2 Small scale production and post-harvest in Nicaragua

Production in countries like Bolivia, Ecuador, Mexico, and Nicaragua has been done for centuries, as it has been a traditional crop of many ethnic native groups. The Codex Mendoza only suggests that Chia reached Bolivia and Ecuador through trade routes pre-Columbine civilizations had in America. Most if not all of the production done in these countries are through small-scale farmers (0.2-1 Ha) or farmer organizations and cooperatives. Production practices differ from farmer to farmer but all are done by hand.

According to a technical production guide done by Ing. Felix Miranda for CECOOPSEMEIN RL. (2012) In Nicaragua two practices are recommended to small-scale farmers. The first practice is the low technology traditional method. This method does not require land preparation, it only demands weed management for seeding. Seed is sown using the broadcast method, although population density and production will vary. The second practice recommended is a more modern approach involving land preparation and small raised bed formation. The sowing of the seed is only done on the raised bed to better control population density. All these practices are done manually.

Similar activities are done towards weed management. Whether this activity is done manually, mechanically, and/or chemically it is important to have no *Amaranthus* species in or the surrounding of the farms. *Amaranthus* degrades Chia seed quality and reduces production by pollinizing the Chia flower and thus creating a non-viable seed, which cannot be sold or sowed. The last activity and the most costly for large-scale producers are the post-harvest activities. Once dried the harvested chia plant has to be shaken and almost beaten to release its seeds, thrashing. During this process the small chia seeds are mixed with leaf and branch particles in a recollection device. To achieve thorough seed cleanliness and selection the material recollected then passes through a filtering mesh; the mesh size needed is 2x2 mm. The mesh is shaken and with help of fans all plant debris and non-viable seeds are removed.

In recent years, Nicaragua has significantly invested in the post-harvest industry of chia. The local Nicaraguan newspaper, La Prensa, reported that the company Acustica invested \$9 million

in processing and post-harvest infrastructure for chia and other specialty seeds. According to the CBI (La Prensa 2014) the horticultural exports, including chia, from Nicaragua to Europe in 2013 was estimated in about \$3 million dollars. The previous remark demonstrates Nicaragua's expansion to new markets other than North America.

2.5.3 Chia genetics

There are general practices that are shared in production and post-harvest activities of Chia regardless of being a large scale producer or a small scale farmer. Currently there is not existence of a certified chia seeds available in the market; large companies like TCC and Benaxia as well as small scale farmers worldwide rely on their own seed production for genetic material. Producers are advised to select the best and healthiest plant for seed recollection. It is recommended that the inflorescence have a minimum length of 17 cm. TCC and Benaxia being large companies with financial backing have been able to obtain a better genetics through trails and establish their own fields for seed production.

2.6 CHIA INVESTMENT PLAN

The chia crop has been used in many Latin American countries likes Argentina, Bolivia, Nicaragua and Paraguay as an alternative high value crop for farmers. In 1996, the studies of Ricardo Ayerza and Wayne Coates introduced chia to the tobacco farmers in Argentina as an alternative cash crop. Their initial trials lead to positive financial results although some difficulties with cultural practices were found at large scale production.

In Nicaragua chia cultivation has been a fundamental cultural crop for small-scale producers. In 2012, CECOOPSEMEIN RL, a farmer Co-op involved in exporting chia recognized the potential of the crop and started the propaganda to encourage other farmers to incorporate Chia to their production cycle due to its high return. Additionally, USAID-ACCESO came up with an investment plan and cost benefit relation of chia to seek the viability of the crop for small-scale farmers, encouraging them to incorporate the crop into their cycle (See Annex 5).

The production of 1 Ha of Chia with irrigation has a total cost of L93,200 and a profit of L161,000. Thus resulted in a benefit-cost ratio of 1.73, almost 200% over investment. The production of 1 Ha of Chia without irrigation had an estimated cost of L60, 700 and a profit of L88,500. This resulted in a benefit-cost ratio of 1.45, close to 150% over investment. Table 2 and table 3 depict the production cost of Chia, the net-profit, and the cost benefit relation based on 1 hectare of production with irrigation and without irrigation.

Table 2: Chia seed with irrigation (1 Ha) cost-benefit relation.

Profit	L 161,000
Total Cost	L 93,200
Net Profit	L 67,800
Benefit-Cost Ratio	1.73

Table 3: Chia seed without irrigation (1 Ha) cost-benefit relation

Profit	L 88,500
Total Cost	L 60,700
Net Profit	L 27,800
Benefit-Cost Ratio	1.45

2.8 CURRENT INFRASTRUCTURE STATUS OF HONDURAS

Following research undertaken by the United Nations (1999), during October 1998, the heavy rain and floods of hurricane Mitch affected and destroyed the infrastructure in Honduras. The hurricane caused enormous damage to the national road system. In the hills and mountainous sector of the central and western regions of Honduras the main damage was caused by material swept along by floodwater. The cost of repairing such damages and a level of environmental restoration integrated to the technical aspect of restoration were extremely high.

Up to 2005, The World Bank approved around \$47 million for a Rural Infrastructure for the country, with 40% was destined to road and highway construction (World Bank 2005). Improvements and reconstruction bettered the rural populations, especially in the western mountainous region, access to fair quality roads. Unfortunately during 2006-2009, much of the government budget went unaccounted for and hindered the quality of work done in the rural Infrastructure project.

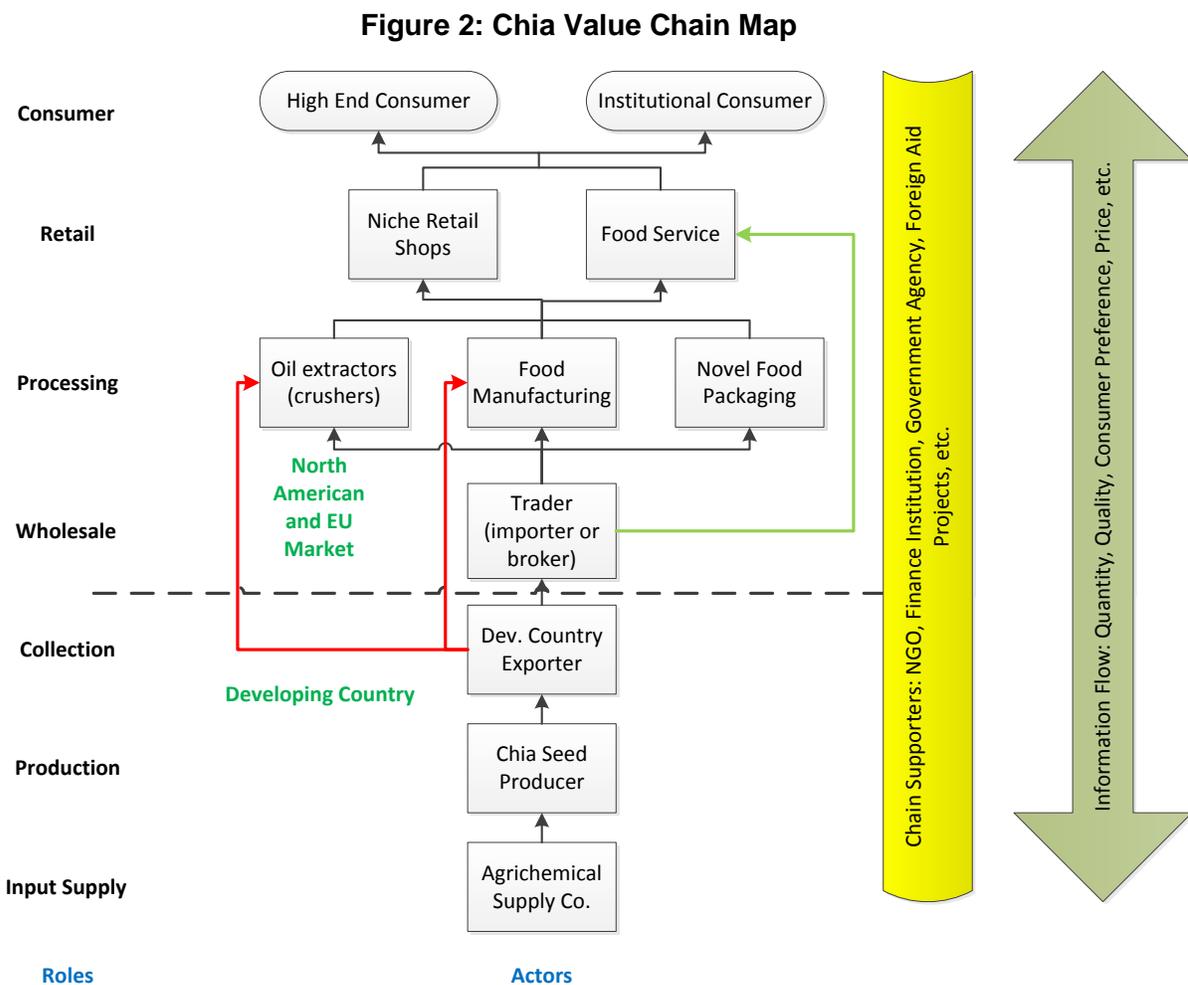
Although progress has been made since 2005, many communities in the rural areas, especially in the western mountainous region, still have limited access to fair roads. In 2013 Honduras once again applied for an additional credit of \$20 million to the World Bank for what is thought as the finalization of the initial Rural Infrastructure project. The funding was approved on May 2013 and the project took effect on January 2014. It is stated that an estimated 33% of the total budget will be used to complete the rural area road system (World Bank 2013). A total of about \$25 million was invested by the World Bank between the years of 2005 and 2013.

Currently, Lempira only counts with one paved secondary road coming from another department, Intibucá, passing the municipalities of Belen and Gracias and heading to the department of Copan. The rest of the roads in Lempira are narrow dirt roads with very little maintenance. (See Annex 6).

2.9 VALUE CHAIN CONCEPT

The term value chain was first popularized in the book *Competitive advantage: creating and sustaining superior performance*, published in 1985, by Michael Porter. In more recent work done by Kaplinsky and Morris (2001) the value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

The value chain mapping will help identify the different actors with their roles and relationships. It will also aid in answering further sub-questions like the different markets and trends, product flow, and value share. Figure 2 depicts the general view of the current value chain of Chia suggested by CBI (2013).



The value chain allows a thorough examination of each stakeholder by identifying the different actors, supporters and influencers. Additionally such analysis enables to identify who is the chain coordinator, who is the lead firm, the most vulnerable actor, and the role of the different supporters.

2.10 CHAIN SUPPORTERS AND INFLUENCERS

Fundación Hondureña de Investigación Agrícola (FHIA) is a private organization offering research programs, training programs, technical consulting, laboratory services, and agriculture marketing and information services to stimulate Honduran agricultural development and exports.

Escuela Agrícola Panamericana Zamorano is an international university that offers young people from different places and origins the opportunity to become disciplined professionals and successful leaders committed to the responsible management of natural resources, rural development and global competitiveness. The university aids in research programs, information services, and laboratory services (Fintrac Inc. 2014).

The Foundation for Rural Enterprise Development (FUNDER) is a Honduran capacity building foundation that transforms farmers into competitive rural entrepreneurs. FUNDER is a foundation that currently works in 14 out of 18 departments of Honduras (Including Lempira) through training programs, technical assistance, and investment facilitation to form rural finance opportunities, SME's, and renewable energy initiatives (Fintrac Inc. 2014).

Fintrac, via USAID-ACCESSO, a woman owned and US-based consulting company. Fintrac helps develop agricultural solutions to end hunger and poverty. For more than 20 years, Fintrac have worked with local and global partners to increase production, improve postharvest handling, add value, and develop markets and competitive value chains for the world's most vulnerable farmers and communities. (Fintrac Inc. 2014)

3. METHODOLOGY

This Chapter describes the methods employed in the thesis. The research area and the research method are based upon the analysis of various sources of data that include development reports, technical data from production and post-harvest documents, humanitarian research and market literature. To achieve this particular objective we need to take into consideration both qualitative and quantitative inquiry methods. The data was collected through desk study, interviews using a checklist, and survey using a semi-structured questionnaire. The interviews were conducted via Skype, while the USAID-ACCESO extension officers conducted the surveys on the farmers. All three of these methods were used to collect primary and secondary data of the Chia crop, its current status, and the potential of being a viable high value crop for the small-scale farmers in the remote regions of Lempira.

3.1 STUDY AREA

The sample area chosen was the department of Lempira (14° 35' 0" N, 88° 35' 0" W) located in the western region of Honduras, considered to be the poorest region of the country (See Figure 3). The department of Lempira has an area of around 4,290 km² and an estimated population of 250,000 people. Most of the economy of Lempira is based on agriculture; coffee, maize, beans, and tobacco are fundamental crops. The municipalities targeted were Erandique, Gracias, Gualcinca, La Iguala, Piraera, San Marcos de Caiquin, San Sebastian, and Virginia (See Figure 4). The introduction of chia into the crop production cycle had a positive impact do to the remote location of the farmers plot, limited means of transportation, and at the same time achieve higher revenue.

Figure 3: Map of Honduras (Source: Maps of world 2014)



Figure 4: Map of Lempira (Source: Maps of world 2014)



3.2 CONCEPTUAL FRAMEWORK

Figure 5: Conceptual Framework

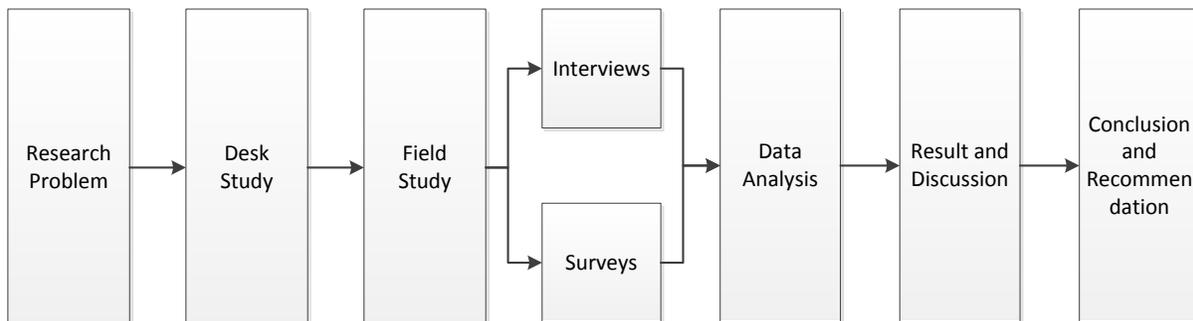


Figure 5. Shows the planned steps of research conceptual framework from beginning to end. The approach of this research covers both quantitative and qualitative data. Data collection was

done by desk study and field study. The field study was based on interviews and surveys. Finally, a conclusion and recommendations were handed based on results

3.3 DESK STUDY

Materials utilized include latest development reports, humanitarian research publications, internet sites, and books related to Chia production and post-harvest management in the Central America and similar projects around the world. Additional governmental and development project documents on market insights, legislation, and important chain actors, were also used. The desk study used pretends to answer both research and the respective sub-questions for background information and cross-referencing with results.

3.4 FIELD STUDY

The field study focused on the problem owner's involvement in the chia value chain. To analyse the value chain further interviews were done with purchasing agents. Surveys were carried out with small-scale farmers.

3.4.1 Interviews

Personal interviews were conducted to ACCESO Management and extension officers, and purchasing agent/exporter. This was helpful to gain understanding about the current organization of the chia value chain in Honduras, constraints and sovereignty of such chain, and the different markets. Most importantly, the interviews were helpful to frame post-harvest constraints farmers face, showcasing the cost difference between farmers in remote areas and farmers in more accessible regions, and the viability of chia as a high value crop for these farmers.

Table 4: Interview I: USAID-ACCESO management and extension team. (See Annex 7)

Interviewee	Position	Purpose of Interview	Interview Method
Mr. Ricardo Lardizabal	Director of On-farm Production USAID-ACCESO	To receive information about ACCESO's experience with past high value crops and potential of chia.	Phone call via Skype
Mr. Ali Valdivia	State Production Manager of Lempira USAID-ACCESO	To receive information about the current situation of the small scale farmers, chia potential, and logistical situation of farmers. Also, gather information on ACCESO's involvement.	
Mr. David Portillo	Zone Manager of Erandique USAID-ACCESO	To receive information about the current situation of the small scale farmers, chia potential, and logistical situation of farmers. Also, to receive a more in depth analysis of the farmers in their areas and gather information on ACCESO's involvement.	
Mr. Erick Meza	Zone Manager of Gualcince, Piraera, and Virginia USAID-ACCESO		
Mr. Rene Carcamo	Zone Manager of Gracias USAID-ACCESO		
Mr. Darwin Suazo	Zone Manager of La Iguala USAID-ACCESO		
Mr. Edgardo Varela	Marketing Officer USAID-ACCESO	To receive information on the current value chain in Honduras, actors, and market.	Email correspondence

Table 5: Interview II: Purchasing Agent/Exporter. (See Annex 8)

Interviewee	Position	Purpose of Interview	Interview Method
Mr. Jesus Nataren	Operation Manager PROHGSA (Export firm)	To receive information on the current market and potential of chia, where their market is, and quantity sold.	Phone call via Skype
Mr. Gilberto Galo	Managing Sales Representative Agronorte S.A. (Export Firm)		
Padre Fausto Mia	Local Homeopathic Clinic Owner		
Jose Narciso	Local middleman/seller		

3.4.2 Survey to the small-scale farmers.

19 farmers from Lempira were randomly chosen and clustered in groups chosen by the Municipality. The questionnaire included questions regarding the topic: name, age, gender, crop rotation, distance of farm from nearest road, time of travel to nearest road, farm size, and amount produced, and transportation cost (See Annex 9 & Annex 10).

3.5 DATA PROCESSING

The collective quantitative data from the interviews and survey was analysed using Microsoft Excel and SPSS statistical software for the preparation of visual representations. The qualitative data was used to formulate the demographic of the sample group and examine the viability of chia as a high value crop that meets the rigorous post-harvest demands. Results were interpreted and then compared to the relevant literature. Furthermore, qualitative data recollected throughout literature and field research was analysed using tools such as SWOT, value chain map, and economic analysis (benefit-cost ration).

3.6 EXPECTED OUTPUT:

This research follows-up on recommendations and results about Chia seed production as a high value crop that meets rigorous post-harvest demands, increases revenue, and helps create a small farmer inclusive value chain.

3.7 LIMITATIONS

The research conducted for this thesis presented an obvious limitation, besides other influencing factors, the main restraint was the absence of the author in on-field research. Factors beyond the author's influence prevented the research in Honduras and therefore the methodology was limited to interviews and a survey. Correspondingly, the interviews presented restraints as they were conducted via Skype and not face to face. For example, the Sales representative from Agronorte S.A. was very frugal with his answering; the lack of physical contact between the interviewer and all the interviewees created certain biased answers and limited some perceptions. The survey itself had foreseen other limitations; especially because the target population of the survey was limited to the USAID-ACCESO extension officers who carried the actual fill out of the survey. The number of interrogations was limited and delivered as closed questions. Personal inquiries such as income could not be asked as it was deemed imprudent to pursue such matter without being present.

4 RESULTS AND DISCUSSION

The following chapter provides the results from the field investigation from both interviews and surveys. The results go in according to the research methodology and focuses on the 2 main data sets accordingly to the following criteria: The first part aims to present the current findings on the situation of small scale farmers in Lempira and discuss the chia potential for these farmers compared. The Second part aims to present the current situation of the Chia value chain in Honduras and discuss farmers and buyers/exporters product benefits.

The interviews were successfully completed to the USAID-ACCESO Director of On-farm Production: Mr. Ricardo Lardizabal, Director of Marketing: Mr. Edgardo Varela, Deputy Production (State) Manager of Lempira: Mr. Ali Valdivia, and 4 Senior Mentor Agronomists (Zone Managers): Mr. David Portillo, Mr. Erick Meza, Mr. Rene Carcamo, and Mr. Darvin Suazo. Also interviews were carried out with two Chia exporting firms: AGRONORTE via Mr. Gilberto Galo and PROHGSA via Mr. Jesus Nataren and two local market sales men from Honduras: Padre Fausto Milla and Mr. Jose Narciso. Surveys were conducted to 19 farmers from 7 different municipalities (Zones) (See Annex 11 & Annex 12).

4.1 FARMER DEMOGRAPHICS

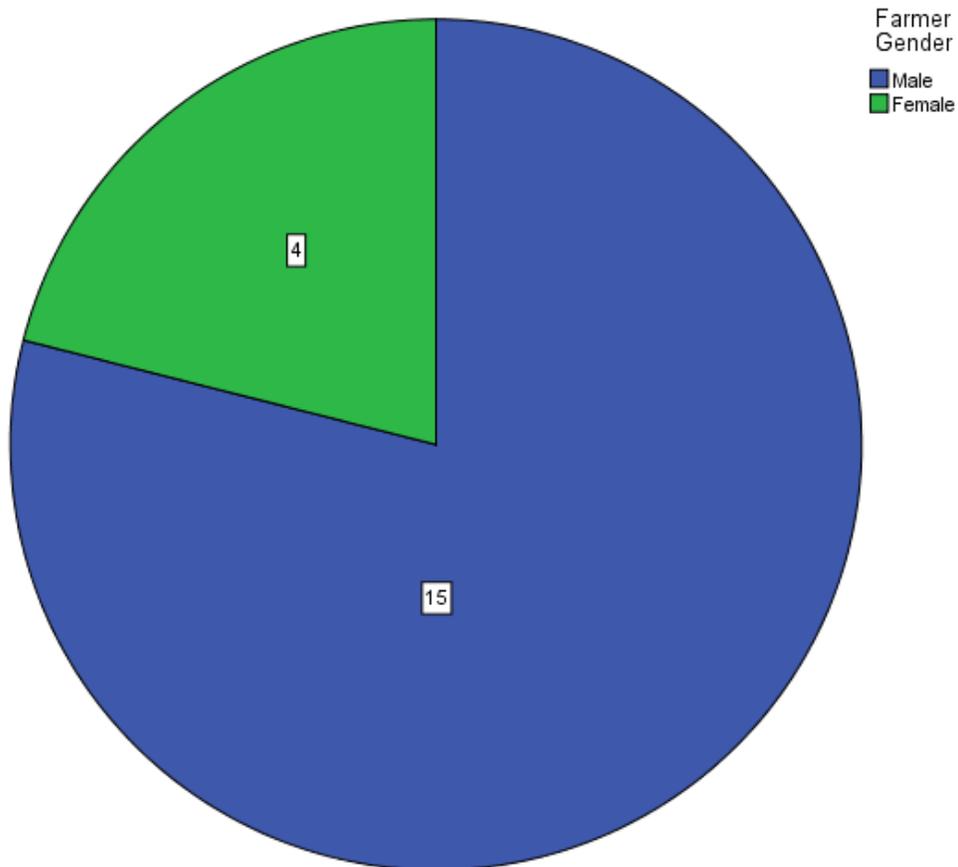
The total 19 farmers that were surveyed had an average age of 55 years. The minimum age from the sample group was 38 and the maximum age was 74 (See Annex 13). Table 6 depicts the mean age of the surveyed group. The results showed a high average age for the farmers. One can suggest that this can be directly or indirectly related to the vast population migration towards North America. Most of the population that has migrated out of the country is of the working age, 18-45, and the majority of who come from impoverished regions of Honduras like Lempira.

Table 6: Farmer mean age

Statistics		
Age group of farmers		
N	Valid	19
	Missing	0
Mean		54,68
Std. Deviation		11,324

The survey also collected each farmer's gender. Out of the group of 19 farmers there were a total of 4 female farmers and 15 male farmers. Figure 6 depicts the number female and male farmers from the survey. All the farmers interviewed are the current owners of their property. USAID-ACCESO encouraged equal gender participation in their activities and encouraged women to partake in production activities. Considering Honduran male influenced culture, it was evident that the participation of 4 female farmers was a breakthrough. In the past, women were portrayed only as child bearers and assigned to home duties. They have slowly shifted into their roles as breadwinners.

Figure 6: Farmer Gender



Other demographics recollected by the survey were the farmer's family size and farm size. According to our results the average family size was between 4 to 5 members. The smallest family size consisted of 3 members and the largest consisted of 6 members. Table 7 depicts the different family size of our farmer group. Most of the family constituted of a spouse and young children.

Table 7: Farmer Family Size

Farmer family size				
	Farmer	Percent	Valid Percent	Cumulative Percent
Valid 3	3	15,8	15,8	15,8
4	6	31,6	31,6	47,4
5	8	42,1	42,1	89,5
6	2	10,5	10,5	100,0
Total	19	100,0	100,0	

Regarding farm size, the average farm size was between 500-1,000m². The smallest farm size was less than 500 m² and the largest farm size was between 1,501-2,000m². The Table 8 depicts the different clustered farm sizes owned by the farmers.

Table 8: Farm sizes

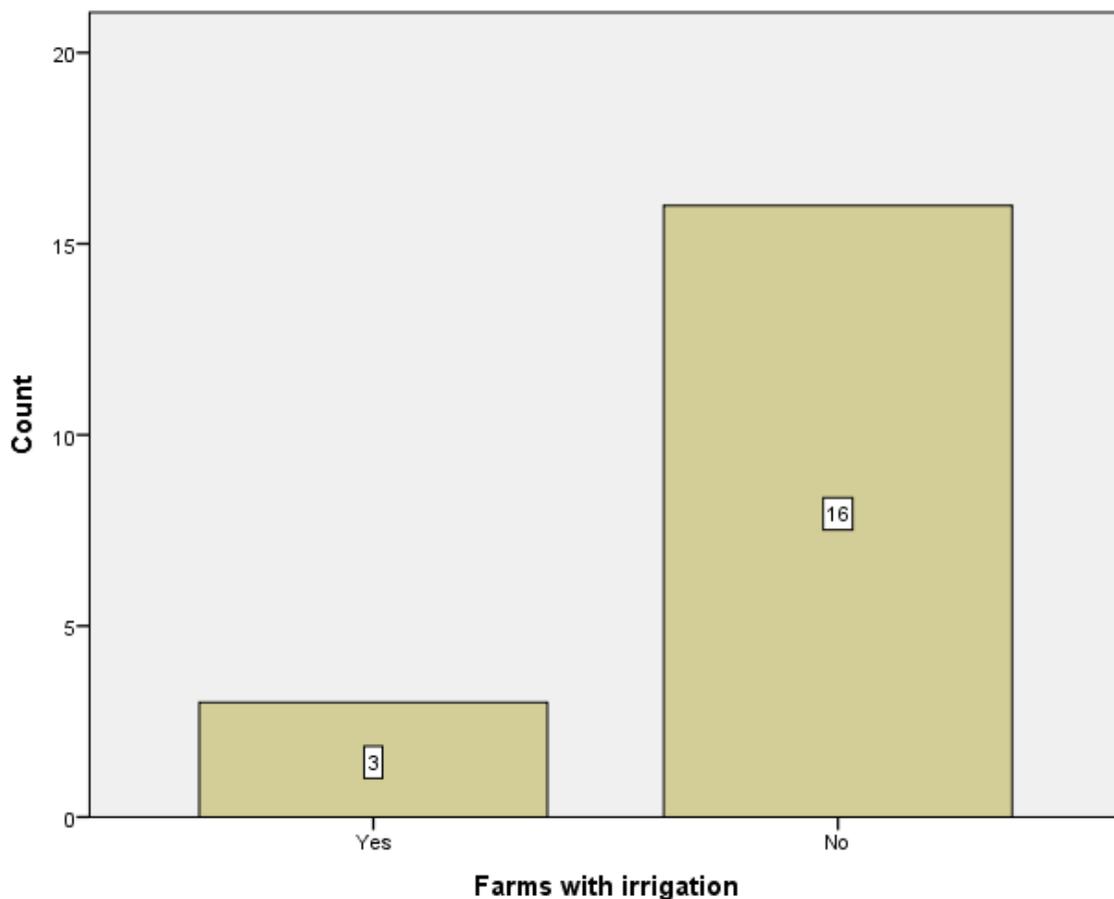
Farm size				
	Farmers	Percent	Valid Percent	Cumulative Percent
Valid 0-500m ²	4	21,1	21,1	21,1
501-1000m ²	9	47,4	47,4	68,4
1001-1500m ²	3	15,8	15,8	84,2
1501-2000m ²	3	15,8	15,8	100,0
Total	19	100,0	100,0	

4.2 CURRENT FARMING SYSTEM

Through the data collected via the survey we were able to determine the farming systems the farmers possess. It also made it possible to determine farm size, irrigation information, and distance from their house to their farm and from the farm to the road. The survey also allowed us to determine what crop rotations the farmers utilized and helped us increase awareness on the small farmers' current situation.

Currently the majority of the farmers do not have any means of irrigation. Of the total group only 3 had irrigation systems on their farm and the remaining 16 relied on rainwater. Figure 7 depicts the farmers with irrigation and no irrigation. The access to irrigation showed great significance for the farmers, not only was production increased with irrigation but also it allowed a better care for the crop and potential to grow other high value crops during dry season. The mountainous region of Lempira contained aquifers and springs where a group of farmers installed irrigation line and split costs. The return upon the irrigation investment could be returned in a couple of growing seasons with market driven crops in rotation.

Figure 7: Farms with or without irrigation.



Important information was then recollected regarding the farmers' distance from his house to the farm. The survey results showed that all the farmers lived on their farm, 15 farmers lived within 10 meters from their farm area. Three farmers lived between 11-20 meters from their farming area and 1 farmer lived between 21-30 meters from his farming area. Table 9 depicts the frequency of farmers regarding the distance of their house to the farm area.

Table 9: Distance house-farm

		House to Farm distance			
		Farm	Percent	Valid Percent	Cumulative Percent
Valid	0-10mt	15	78,9	78,9	78,9
	11-20mt	3	15,8	15,8	94,7
	21-30mt	1	5,3	5,3	100,0
	Total	19	100,0	100,0	

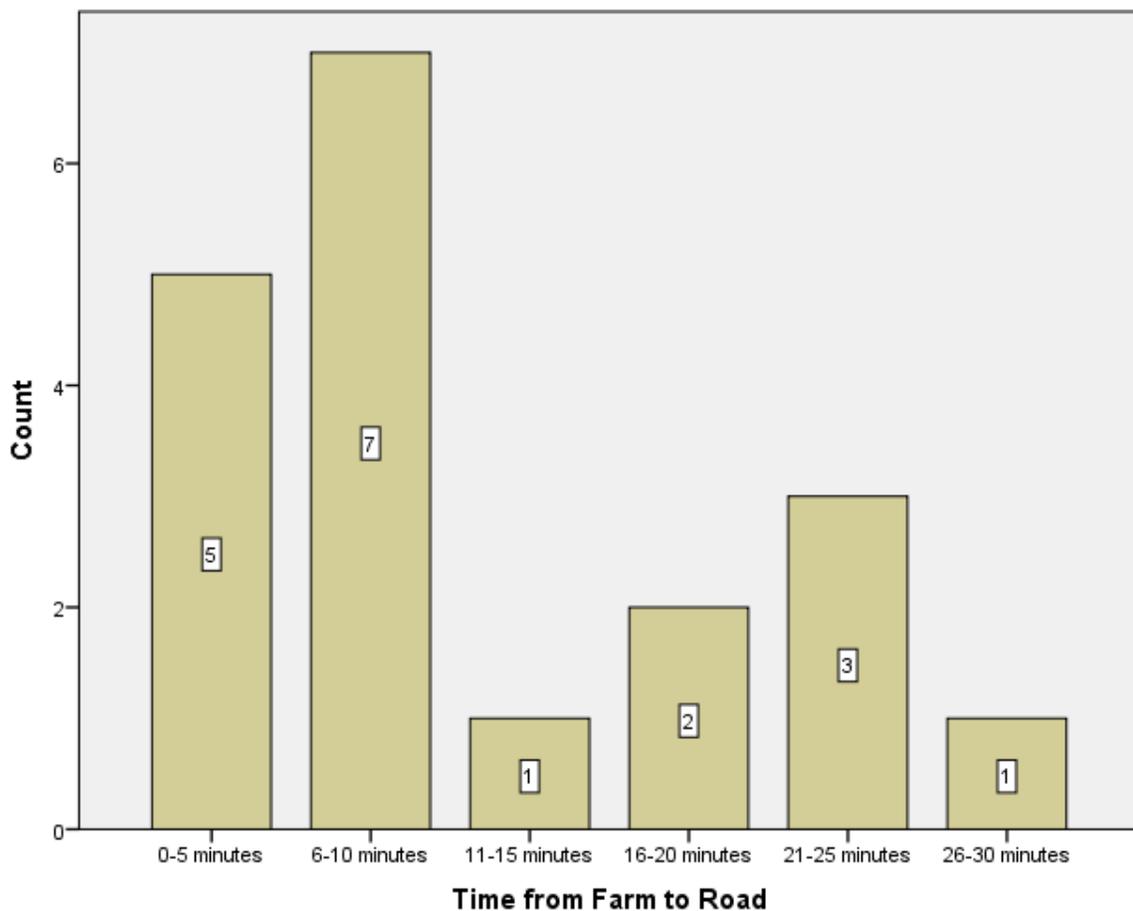
Furthermore, information on the farm distance from the nearest road and the time to reach the road was obtained. According to the findings 12 participants have their farm within 25 meters of their property. Additionally 2 farmers had their farm within 201-250 meters from their road, being the longest distance presented between farm and road. Table 10 depicts the frequency of farmers regarding their farm to the nearest road.

Table 10: Distance farm-road

		Farm to Road Distance			
		Farm	Percent	Valid Percent	Cumulative Percent
Valid	0-25mt	12	63,2	63,2	63,2
	76-100mt	2	10,5	10,5	73,7
	101-150mt	2	10,5	10,5	84,2
	151-200mt	1	5,3	5,3	89,5
	201-250mt	2	10,5	10,5	100,0
	Total	19	100,0	100,0	

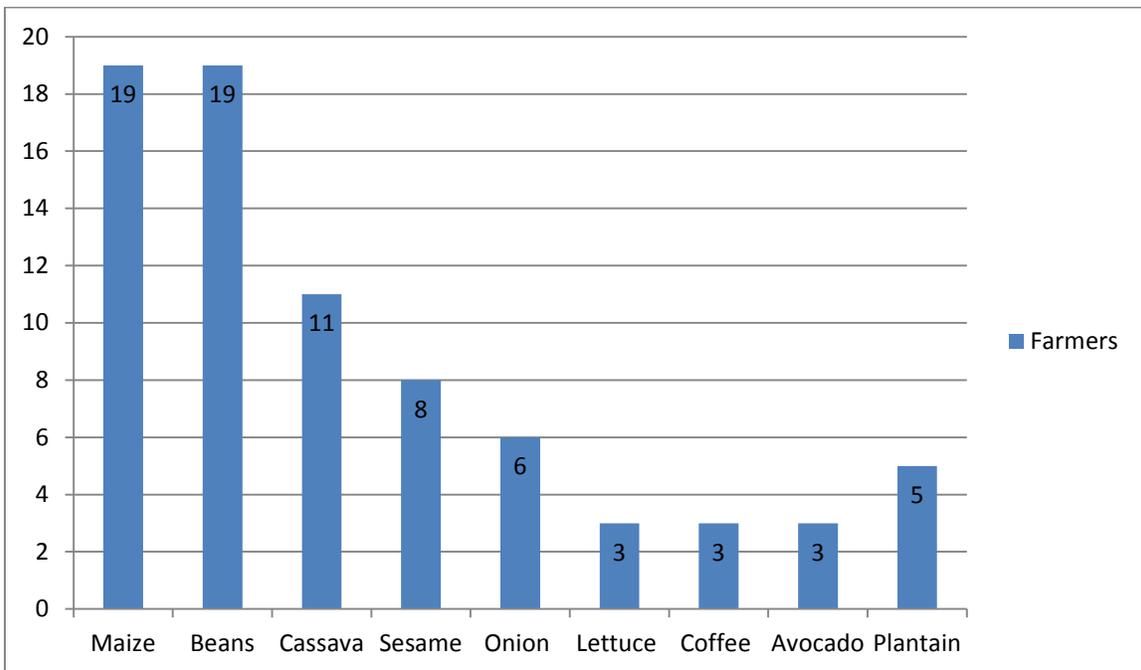
Also, time was used as a measurement to help illustrate a key aspect in the farmers' logistical challenges. The majority of the farmers, 12, had their farm within 10 minutes from the road and 1 farmer had his farm between 26-30 minutes to the road. Figure 8 depicts the farmer count according to the time it takes them to reach the nearest road from their farm. Farmers that had a distance of over 15 minutes to the nearest road would have encountered a difficult time transporting perishable goods in a 50kg sacks to the road without suffering from physical damage. Chia's hard shell case enabled a better viability of withstanding the physical treatment received during the time it took the farmer to reach the road and prevent losses. The risk of having more losses from physical damages would be greater to these farmers than those living less than 10 minutes from the road.

Figure 8: Time farm-road



Additional information regarding the farmer’s crop rotation was acquired. The survey results of small-scale farmers’ crop rotation consisted on subsistence crops like maize and beans. Although USAID-ACCESO has already introduced high value crops like onion, sesame, and chia in the area, all 19 respondents grew maize and bean in their yearly crop rotation (See Annex 14). The most common crop after these was cassava, 11 of the 19 (60%) targeted farmers used cassava in their crop rotation. Further results demonstrate the acceptance of sesame into the farmers’ crop rotation; there were 8 of 19 farmers who had sesame in their crop rotation, roughly 40% of farmers. This is important to the farmers want to grow chia because the same purchasing agents for the sesame seed purchase the chia seed. Other crops that were included in the farmers’ rotation were lettuce, and onion while avocado, coffee, and plantain are permanent crops also very important income crops. Figure 9 depicts the frequency of crops used with chia by the different farmers in their crop rotation.

Figure 9: Frequency of crops used on crop rotation

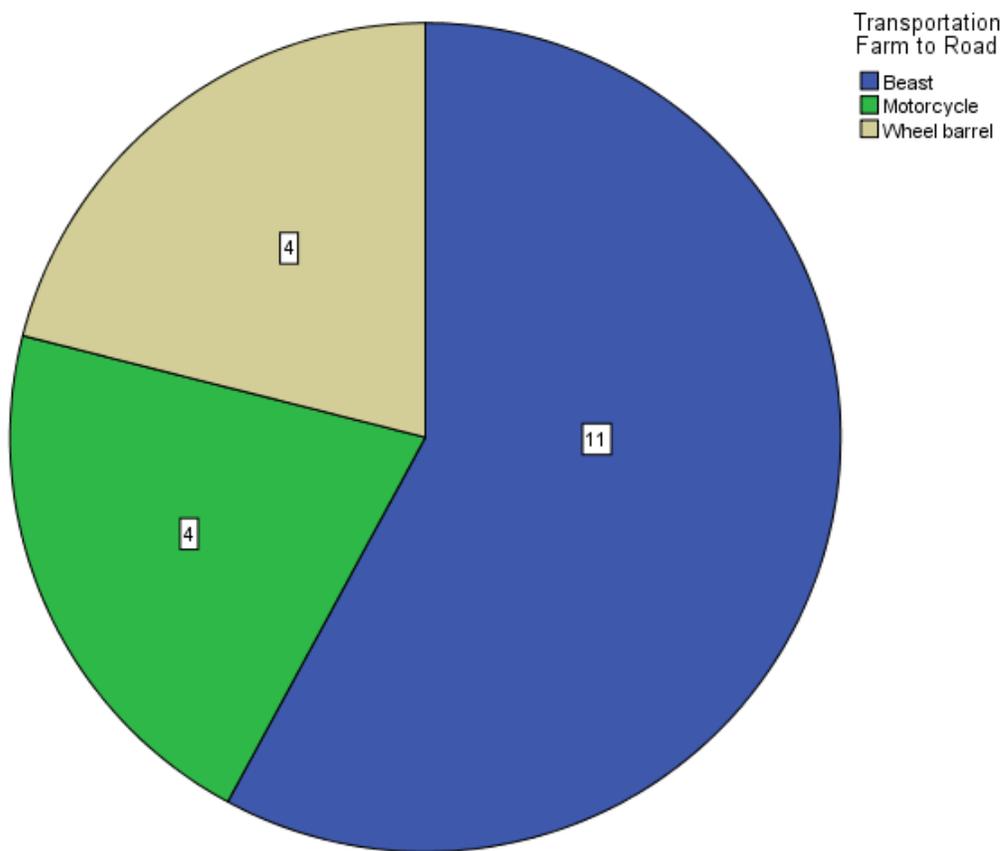


4.3 TRANSPORTATION METHODS AND COST

The survey portrayed results on different methods of transportation and cost each farmer incurred for logistical movements of their products. Information on the methods of transportation of their final product from the farm to the road and final transportation to the market destination was obtained. The majority, if not all, farmers transport their goods to the market in 50 kg burlap or poly sacks. Three of the most experienced farmers grew iceberg lettuce and used plastic crates for its transportation to the market.

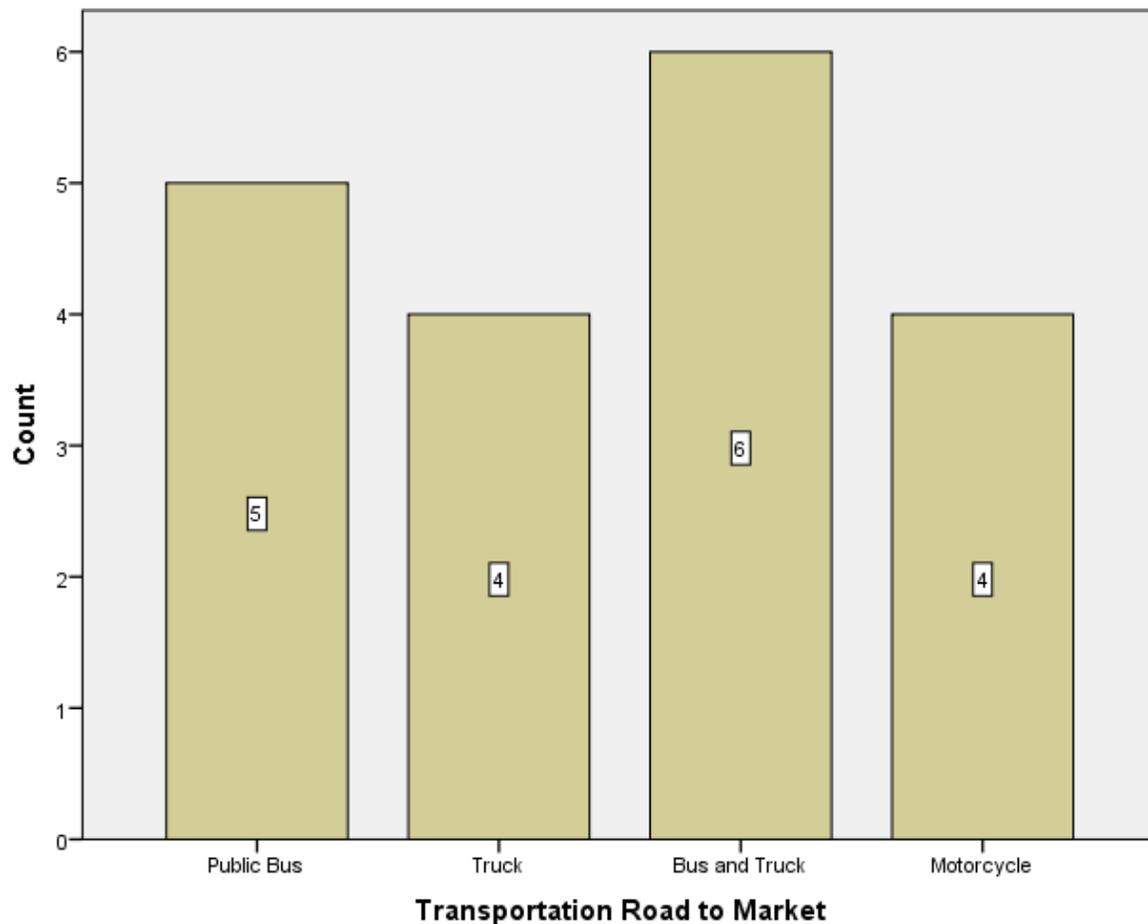
Of the 19 farmers asked for the methods of transportation of their final product from the farm to the road the majority, 11, responded to using a beast as their method of transportation. Other methods of transportation used by 4 farmers were a wheel barrel. The other 4 farmers owned motorcycles which they used to take their product directly to the market. The figure 10 depicts the frequency of different transportation used by the farmers. One would imagine the impact on quality perishable vegetables would have if they were transported in a 50kg sack on a wheel barrel or beast 15-20 minutes to the road. Post-harvest transportation losses would have occurred upon departure from the farm. Even the farmers with motorcycle would have been prone to physical damage loss just from getting their product out of their farm to the road. Chia on the other hand does not need the special attention perishable products require to prevent physical damage or bruising.

Figure 10: Frequency use of different methods of transportation farm-road.



Results demonstrated the different methods of transportation used for the logistical movement of their product from the nearest road to their property to the market. A group of 6 farmers used either public bus and/or private truck as a mean of transportation to take their products to the market. Another group of 5 farmers used public bus for their logistical service. Additionally, one group of 4 farmers used a private truck for transportation and the 4 farmers that have motorcycle are responsible for their own logistical movements to the market. Figure 11 depicts the frequency use of the different methods of transportation to the market by the farmers.

Figure 11: Frequency use of different logistics to the market by farmers.

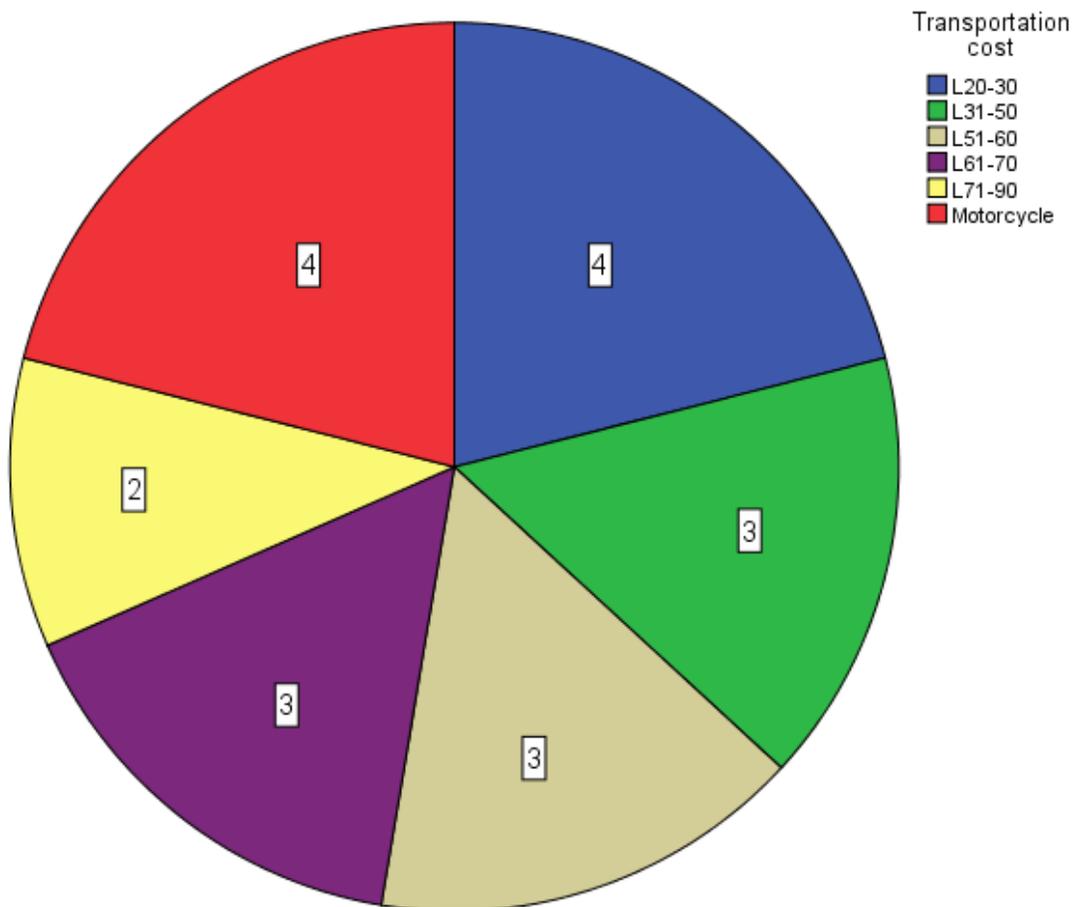


According to the surveys carried out most of the farmers, if not all, used public busses and/or merchant runner (trucks) in order to transport their products to the market. According to USAID-ACCESO's Department manager, Mr. Ali Valdivia, "the *farmers lack financial capability to hire private means of transportation for their products and have to rely mostly on public transportation*". Additionally Mr. Valdivia's claim was supported by the survey results that depicted that 5 farmers used public bus, other 6 used either bus or truck, and 4 farmers used merchant trucks. While 3 farmers have their own motorcycle and assured their method of transportation.

In addition, farmers had their own internal logistical movement to get their product out of their farm into the road. As the survey results portrayed more than half of the farmers, 11, used a beast (mule, horse, and/or donkey) for this logistical movement. This action increased the post-harvest losses incurred by these farmers with fresh vegetables and helped emphasize USAID-ACCESO's search and testing of high value crops with low post-harvest management requirements like the chia crop.

Through the survey results we obtained the different costs of transportation by farmer. The 4 farmers that owned their own motorcycle incurred in petrol cost. A group of 4 farmers had a transportation cost between L20-30 while a group of 3 farmers had a transportation cost between L31-50. Additionally, 3 farmers had logistical costs between L51-60 and another 3 farmers between L61-70. Finally, 2 farmers had transportation costs between L71-90. Figure 12 depicts the clustered farmer groups by transportation cost.

Figure 12: Farmer transportation cost.



When cross-referencing the transportation costs incurred by some farmers and their municipality a direct relation with the distance of their municipality to the state capital of Lempira, Gracias and their logistical cost was found. The farmers located in the Municipality of Piraera had the highest transportation costs, L71-90, due to their distant location to Gracias, roughly 70 km South East. The farmers in the municipalities of Erandique and Gualcince, located roughly 50 km south east of Gracias, had the second highest logistical cost, L61-70. Furthermore, the 3 farmers located in San Sebastian, roughly 30 km south of Gracias had a cost in between L51-60. The farmers located in the municipality of La Iguala had the second lowest logistical costs, L31-50, because of the proximity to Gracias. Finally, the 4 farmers located in Gracias had the lowest transportation cost, L20-30. Table 11 depicts the transportation cost in relation to the Municipality where the farmers were located.

Table 11: Table Municipality-Transportation Cost Relation

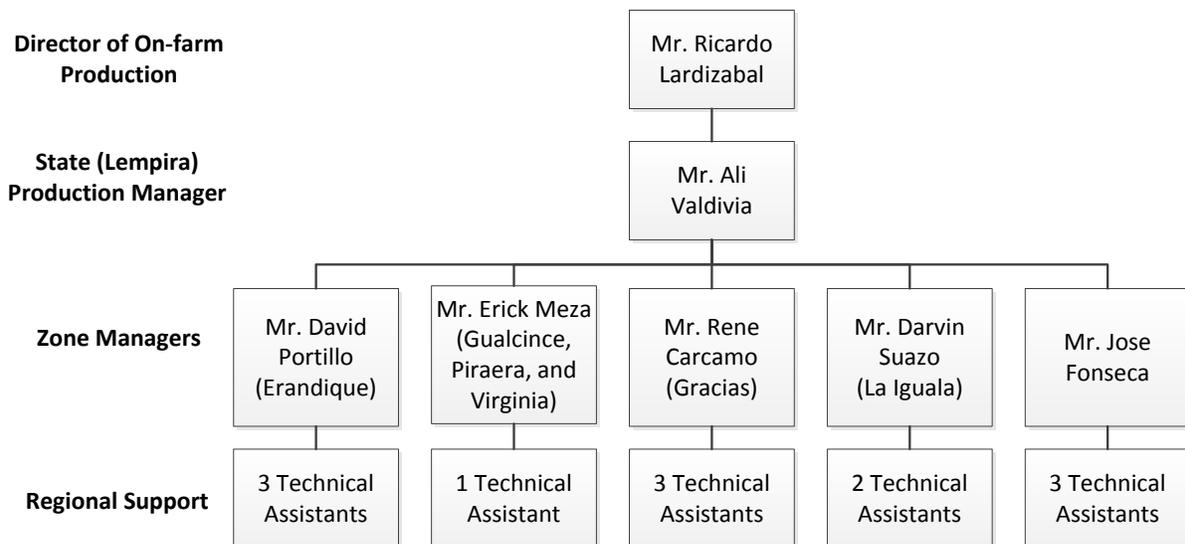
	Transportation cost						Total
	L20-30	L31-50	L51-60	L61-70	L71-90	Motorcycle	
Gracias	4	0	0	0	0	0	4
La Iguala	0	3	0	0	0	1	4
San Marcos de Caiquin	0	0	0	0	0	1	1
San Sebastian	0	0	3	0	0	0	3
Erandique	0	0	0	2	0	1	3
Gualcince	0	0	0	1	0	0	1
Piraera	0	0	0	0	2	0	2
Virgina	0	0	0	0	0	1	1
Total	4	3	3	3	2	4	19

Gracias is the state capital of Lempira. All the commerce from Lempira was usually shipped to the markets via collection centres and markets in Gracias. The municipalities of La Iguala and San Marcos de Caiquin are located next to Gracias and have easier access to Gracias. Municipalities like San Sebastian, Erandique, and Gualcince are in more remote areas of Lempira, although San Sebastian has better access to Gracias than the other two municipalities. Finally, Gualcince, Piraera, and Virginia are the furthest to Gracias from the rest of the municipalities; hence the cost is reflected to be more for these areas than the rest.

4.4 USAID-ACCESO ORGANIZATION IN LEMPIRA.

Conferring the interview carried out with USAID-ACCESO's Department manager of Lempira, Ali Valdivia, there was an extension team of one Deputy Production (State) manager, 5 Senior Mentor Agronomist (Zone manager), and 12 technical assistants, 1-3 per zone manager; this being a total of 18 on-field extension officers (See Figure 13). All of which provided technical assistance and support to the farmers in Lempira. Figure 13 depicts the organizational structure of USAID-ACCESO in Lempira. Mr. Ali Valdivia received a Masters in Science in Plant protection and has been working with USAID-ACCESO since it started. All four zone managers interviewed obtained a Bachelor in Science relating to agriculture production and have been working with the project for 3 years

Figure 13: Organization chart of USAID-ACCESO extension team in Lempira.



4.5 CHIA CROP CYCLE IN HONDURAS

According to interview carried out with Mr. Ali Valdivia and the 4 zone managers the chia production season in Honduras begins in with land cleaning and weeding between the months of July and August, depending on the preparedness of the farmers land. Seed sowing is done in the month of September in order to achieve harvesting and collection during the North American market window. Conferring with Mr. Valdivia Chia weeding is done the 1st and 3rd week after planting to avoid competition, which was then confirmed by the 4 zone managers that were interviewed. Furthermore, pest management of the crop is minute; management is only needed during the first 5-6 weeks of the crop. The interviewed ACCESO team in Lempira only identified two major pests for Chia crop: cutter ants, *Atta cephalotes* and *Atta mexicana*, and slugs of the *Arionidae* family. Fertilization of the chia crop is done two during the growing cycle, this first time after seed germination and the second time when flowering begins. Harvesting is done during the months of January and February, which involves uprooting the plant and letting it dry on the

field with a plastic cover to avoid moisture. Finally in the months of February-March, once the plants have dried the material is beaten on plastic tarps to remove the seeds (thrashing) and then separated any debris from the seeds with aid of the wind. Once the seeds are cleaned then they are sold to the market, farmers only keep and store the necessary seeds needed for next year's harvest. Chia's full production from sowing to seed recollection is roughly 5 months, from September to January. This schedule also follows into the rain season of May and June and the hurricane season of November and November of Honduras (See Table 12). This schedule allows for moisture accumulation in the ground before planting and rainfall during plant formation but not until flower polarization, providing security from rainfall destroying the crops at the final and crucial stage of seed formation. Mentioned in the literature review, Bolivia lost around 50% of their crop to excess rainfall.

Although chia production is oriented towards the North American market window, much has to do as well with the specific photoperiod required by the plant. This important fact reinforces what the founder of TCC, Mr. Foss, stated in the literature review of Chia being very latitude dependent.

Table 12: Chia Agriculture Calendar, Honduras.

	1	2	3	4	5	6	7	8	9	10	11	12
Cleaning land												
Weeding												
Seeding												
Fertilizing												
Pest (IPM)												
Harvesting/Drying												
Seed Removal & Cleaning												

4.6 THE CURRENT CONSTRAINTS AND INFRASTRUCTURE OPTIONS FOR FARMER IN LEMPIRA.

USAID-ACCESO's Department manager, Mr. Ali Valdivia, stated that the majority of the producers in the remote areas of Lempira are small scale farmers with lands size < 2,000 m2. The land size is a real constraint to how much area the farmers can produce a cash crop since other crops like maize and/or beans were grown at the same time. Mr. Valdivia's comments

were in accord to the survey results, 19 farmers that were surveyed the largest farmer did not have more than 2,000 m² of farm land and the smallest having around 450 m².

Another constraint Mr. Valdivia, USAID-ACCESO's Manager for Lempira, mentioned was how farmers' agricultural practices lacked some technological input: little to no land preparation is done, most rely on rainfall for irrigation, and nutritional and pest management is minimum (low level agricultural practices). Very few farmers in the department have a technical investment like an irrigation system. *"The level of agricultural practice really limits what crop they can produce and the yields they can obtain, but this is the reality these farmers live in. Still, we have to aid them in doing the best they can with what they have. We can teach them good cultural production and post-harvest practices and crops that can be successful and beneficial according to their circumstances."* The survey results from the farmers reinforced this fact, when only 3 of the 19 farmers surveyed had irrigation systems.

An additional constraint about farmer's limited financial access was pointed out by Mr Valdivia. Farmers are so small it is difficult to get finance for inputs. Their farm size is so little that it does not serve as a valid guarantee. This constraint is supported once again by producer farm size, the lack of adequate infrastructure, and access to the farms.

Mr. Valdivia also stressed out that the current infrastructure in Lempira does not benefit small-scale farmers. *"Vehicular transportation from the farms to the nearest town has its limitations. Most routes are dirt roads that are barely maintained by the government. Farmer access to roads is difficult thus getting their products out of the farm to the market and obtaining input supplies is problematic."* Also, this inhibited their access to the market and transportation options. The responses agreed with the correlation found between transportation cost and farm location from the capital of Lempira, Gracias. These claims also are supported when comparing the cost difference between the farmers in remote municipalities like Piraera and Gualcince to the farmers located in Gracias or La Iguala. The farmers from these remote municipalities have a higher input and output cost do to their increased transportation cost, translating into higher costs than farmers closer to Gracias.

USAID-ACCESO's Zone manager for Gracias and Belen, Mr. Rene Carcamo, confirmed what Mr. Valdivia had stated about the farmers lacking access to finance. Although Mr. Carcamo, assists in the state capital zone, stated many farmers cannot access loans from the financial institutions because the lack some sort of guarantee. Even though the financial institutions are in reaching distance from their properties, most farmers lack viable guarantees to obtain any loans. Also, he stated that preparation, nutrition and pest management activities were kept to the minimum, which can be attributed sometimes to the lack of availability of inputs at the supply stores.

USAID-ACCESO's Zone manager for La Iguala, Mr. Darvin Suazo also mentioned and confirmed that farmers lack financial liquidity and access to finance. Mr. Suazo, located in the neighbouring municipality of La Iguala, specified many farmers cannot access financial aid because the lack of a valid guarantee. Even though the financial institutions are in reaching distance from their farms, most farmers only have their property as guarantees to obtain any loans. Farmer properties are not considered a viable guarantee for banks in Honduras. In

addition Mr. Suazo commented that most of the farmers he attended exercised a low level of agriculture practice and on top the agriculture supply store did not always carry a full stock of supplies.

USAID-ACCESO's Zone manager for Gualcince, Piraera, and Virginia, Mr. Erick Meza assists producers in the most remote areas of Lempira. He mentioned that the roads are sometimes inaccessible during the rainy season and some farmers may spend up to two weeks without access to the town and access to essential inputs. Small-scale farmers stand more difficult circumstances in order to obtain any finance because of their limited options of financial institutions, small property size, and the low property value. According to Mr. Meza, most of the farmers practiced production with low levels of investment and technology. Due to Mr. Meza's zone distance from Gracias, inputs were very hard to get and teaching farmers how organic compost is made was a crucial part of the technical assistance.

USAID-ACCESO's Zone manager for Erandique and San Andres, Mr. David Portillo is also based in the most remote areas of Lempira. Mr. Portillo stated "*transportation was scarce in the remote region of Lempira because of the difficult terrain and the lack of maintenance on the existing after the rainy and/or hurricane season.*" His comment reinforces the literature review over Honduras's existing damage after Hurricane Mitch in 1998. His claim seemed to restate the truth of the government's lack of compromise for the population in the rural west areas of Honduras. Mr. Portillo mentioned his farmers face difficult circumstances in order to obtain any financial aid because of their small farm size and lack of valid guarantees. He added that most of his farmers exercised low levels of agricultural practices but were disciplined on maintaining good cultural practices like weeding and perimeter cleaning. Also farmers were learning how to make their own organic compost.

Overall, all members of the USAID-ACCESO extension team mentioned that the physical access to the market and input supplies is one of the major constraints that rural farmers face. This is mostly due to the insufficient maintenance and/or lack of adequate infrastructure. Moreover, the lack of road systems and accessibility has limited the growth of Lempira and has forced most, if not all, of the logistics and economical activities to go through Gracias. The USAID-ACCESO team also seemed to agree that the input supply store in Lempira does not always stock the necessary input supplies. This in turn, directly affected the farmers who wanted to integrate some form of nutritional or pest management. Mr. Meza and Mr. Portillo were the USAID-ACCESO Zone managers located in the most secluded areas of Lempira and tackled this obstacle by introducing the formulation of organic compost to their technical assistance. This practice is recommended to all USAID-ACCESO extension officers in remote areas. The interview responses seemed to further support the literature review on the current state of the infrastructure, where little investment has been done over the recent years.

Additionally, all USAID-ACCESO members that were interviewed agreed that farmers lack access to financing because of the absence of valid guarantees. Most rural farmers have limited land that is often too small and valued extremely low. Around the years of 2000-2006 many banks allowed farmers to use their properties as collateral and guarantee for loans. The outcome did no favour the banks as many loans were defaulted and the banks were forced to seize the properties from the farmers and as properties had a low market value because of their

undesired location, forcing banks to keep the properties and limiting them from providing financial aid to farmers with no other guarantees than properties. It is now understandable for financial institutions not to accept small farm properties as collateral or guarantees because of their past experiences. Although, with the introduction of market driven high value crops, like Chai, there could be an increase for rural farmers in financial flow and this could eliminate their desperate need for institutional financing.

4.7 CURRENT COST DIFFERENCE BETWEEN FARMERS

The survey results and interviews carried out to the USAID-ACCESO extension team had very similar results towards the cost difference small-scale farmers in secluded had compared to the cost farmers in accessible areas incurred. In the interviews carried out with USAID-ACCESO Zone managers, Mr. Erick Meza and Mr. David Portillo, who are assigned to the most remote areas of Lempira, both commented on the additional expense farmers sustained for inputs and outputs.

The farmers located further from Gracias, like Piraera, Gualcince, and Erandique had incurred in transportation costs to obtain input supplies since the input supply store was located in Gracias. Farmers also had a higher expense when transporting their final product. Survey results reinforced comments that farmers in the municipalities closer to Gracias had a lower cost than the farmers in more remote areas. The farmers in Gracias incurred no input transportation costs and their transportation costs were estimated to be less than half, L30.00, than farmers in the furthest municipality, Piraera, L80.00. Although the cost difference may have seemed minimal in Lempiras, the total cost difference between farmers in Piraera and Gracias, L90.00, constituted roughly 50% of the legal rural daily wage (See Table 13). According to the Wage Indicator Organization (2014), Honduras legal rural daily wage in 2013 was L170.00. Another important factor that placed more emphasis in cost difference was that most farmers on average had a family size between 4-5 members. A L90.00 difference may have enabled the farmers in Piraera to purchase a meal for all their family members.

Table 13: Cost and Value share difference

	Jose Alvarado Municipality: Piraera	Dario Lainez Municipality: San Sebastian	Maria Benitez Municipality: Gracias
Chia Quantity and Sale Price (Total)	40 kg@ L150/kg (L6,000)	40 kg@ L150/kg (L6,000)	40 kg@ L150/kg (L6,000)
Input Transport Cost	L40.00	L20.00	-
Output Transport Cost	L80.00	L50.00	L30.00
Total Cost	L120.00	L70.00	L30.00
Profit	L5,880.00	L5,930.00	L5,970.00
Cost Difference	L90.00	L40.00	-

4.8 ADVANTAGES OF CHIA COMPARED TO OTHER PAST HIGH VALUE CROPS.

An interview done with the Chief Production Manager of USAID-ACCESO, Mr. Ricardo Lardizabal, revealed past and present experiences of USAID's agricultural based projects. He was aware of the necessity that farmers in remote areas, like Lempira, face such limited opportunities to high value crops and markets. Farmers in Lempira are the poorest and most neglected in the Honduran territory, practicing subsistence crop rotation and low incomes, USAID-ACCESO's team considered examples in Guatemala and the string bean industry as a viable option. According to Mr. Lardizabal, String bean production in Lempira first started in 2011 with the intention to sell the product to the Guatemalan industry during export season. The production of the beans came out as planned and harvest was plentiful; farmers were enthusiastic at the development and the possible returns from their crop. Unfortunately, the farmers from Lempira did not fare well in the ordeal. Since the string beans were transported to Guatemala they were shipped through land transportation to the neighbouring country. Due to Lempira's distance to Guatemala the producers relied on their own methods of transportation and logistics, bringing with it higher costs. Other producers from Ocotepeque, Copan, and Santa Barbara were provided logistical services by the Guatemalan export company because they are Border States to Guatemala. The third party person hired by the farmers in Lempira had no knowledge in handling fresh perishable products and had no interest in handling the product in gentle manner. Combining this important fact with the bad state of infrastructure, incurring in higher-losses, by the time the product reached the final destination, around 80 percent of the final product was lost to damage and sun exposure. The general example of the transportation method given was as followed *"1 Quintal (qq) sack of French beans got placed on the bed of a truck or a roof of a bus with no cover from the sun and other things being placed on top. Then cardboard boxes were used, but people would still put heavy items on top of the boxes and would end up squishing the vegetable product"*. This led to the introduction of stevia and chia as a potential viable high value crop that had been rumoured about in Nicaragua that needed very little care during production and had no major post-harvest care than avoiding the product from getting wet. As Mr. Lardizabal stated *"Basically all you need to do is fill your sack with the chia seed, wrap it with plastic so it does not get wet, and put it on the bus or truck with not much worry. When compared to the price of chia we get in our target window the cost of transportation is not an obstacle."*

USAID-ACCESO Zone Manager, Mr. Darvin Suazo, mentioned that, until the past year, eggplant had been the alternative high value crop used to help the small-scale producers of Lempira. He stated *"The first couple of years the crop was very successful providing decent incomes for the farmers and an assured market with a proactive exporting firm. Unfortunately for the farmers in Lempiras the export firm found more products at a better price from Mexico and the eggplant production project got discontinued."*

The small-scale farmers got extremely mad and even hostile because of the losses with the string beans and disappointed with the eggplant project. Due to troubled pass some farmers were even suspicious the theft of their product. After all we learned that the problem was the nature of the product and the location of their property.

Chia had not been grown in Honduras for as far as Mr. Lardizabal could recollect. Seeds were imported from Nicaragua and the first tests were done in Lempira in 2013.

4.9 THE CURRENT SITUATION OF CHIA IN HONDURAS

In Honduras, the most recent and first chia test cultivation was done with 43 small-scale farmers in Lempira in the year 2013 with a harvesting date of January/February 2014. A total land of 1.5 Ha was cultivated; little inputs were needed during the growth and development of the crop. Out of the 19 surveyed farmers, 15 of them were involved in the initial test. The average plot size was around 450 mt² and obtained an average yield of 40 kg. The farmers with irrigation systems had a greater yield, obtaining an average yield of 51 kg from 450 mt². The high yields and good market price of chia was reinforced by the cost-benefit relation provided in the literature review of 1.73 with irrigation and 1.45 without irrigation (See Table 2 and Table 3).

During the 2013-2014 crop cycle the Department manager of Lempira, Mr. Valdivia, and 4 zone managers provided assistance to farmers cultivating chia. Zone Manager, Mr. David Portillo, commented that the initial promotion of chia was tough because the farmers were sceptical and some unwilling to participate. He mentioned that like all new crops, it was difficult to introduce them to the farmers, hence why only test plots were done. During the new coming production cycle of 2014-2015, USAID-ACCESO, involved five zone managers and their technical assistants to introduce chia into the production cycle of most farmers in Lempira. Mr. Valdivia confirmed that an estimated 250 Ha of Chia would be sown this season in Lempira. Not only was USAID-ACCESO promoting chia cultivation with their farmers but they also involved wholesale exporters and national merchants in the chain, providing a direct link between grower and buyer.

4.10 THE CURRENT CHIA MARKET

Mr. Edgardo Varela, market specialist for USAID-ACCESO, shared that an initial market probe to find potential Chia buyers was done by the project before the test crop was carried out. Once the buyers were identified by USAID-ACCESO, they proceeded to introduce the project with interested buyers and began the market linkage between the farmers and buyers. Mr. Varela was able to identify 5 exporting firms and 6 local sales men/women and the estimated quantity the needed (See Table 14 and Table 15).

Table 14: Exporting firm and quantity sold.

Firm	Quantity/Year
Agronorte	50,000 kg
Distribuidora Handal	50,000 kg
PROHGSA	50,000 kg
Industrial de Alimentos	25,000 kg
Jorge Valenzuela	25,000 kg

Agronorte and PROHGSA are firms dedicated to the exportation of commodity seeds and items. General sales representative of Agronorte, Mr. Gilberto Galo, stated that the company is dedicated to the export of specialty coffee, allspice, black and white sesame, and chia. He confirmed that Agronorte has contractual agreements to meet a quantity of 50,000kg demanded

by their consumers, verifying what USAID-ACCESO’s market specialist, Mr. Edgardo Varela, had mentioned. Furthermore, Mr. Galo mentioned that the chia was picked up in the market of Gracias, Lempira, by their own means and brought to their storage and distribution centre in Francisco Morazán, the main department of Honduras, 6 to 9 hours from production grounds, for inspection and shipment (See Annex 15). Mr. Galo seemed very hesitant in his answers and was reluctant to provide further information.

Mr. Jesus Nataren, Operational manager of PROHGSA, stated that the company is dedicated to the export of allspice, black and white sesame, and chia. He confirmed that PROHGSA has contractual agreements with 6 buyers with and overall quantity of 50,000kg. Also corroborating what Mr. Edgardo Varela had stated earlier. Mr. Nataren mentioned that he personally inspects seeds purchased at the market in Lempira and in occasions has travelled with USAID-ACCESO extension officers to meet with farmers who are currently growing sesame for PROHGSA. He affirmed that PROHGSA is looking into the viability of establishing a collection centre either in Gracias, Lempira or La Esperanza, Intibucá another department in Honduras to take advantage of local production and market demand of chia at the same time. PROHGSA facilities are located in Cortes where the chia is stored and shipped; he did not recollect the precise measurements of the warehouse, although he did state that the chia is packed in 50kg polypropylene sacks and then placed on pallets, pallet weight equivalent to 1 metric ton.

Table 15: Local Market salesmen/woman and quantity sold

Salesman/woman	Quantity/Year
Padre Milla	15,000 kg
Jose Narciso	25,000 kg
Martha Argueta	5,000 kg
Eduardo Canales	5,000 kg
Marvin Mora	5,000 kg
Norma Peralta	2,500 kg

Father Fausto Milla and Mr. Jose Narciso are the largest local merchants regarding chia in Honduras, according to USAID-ACCESO’s market specialist. Mr. Milla is a Roman Catholic priest that for over 20 years has been dedicated to homeopathic medicine and holistic healing in Honduras. A native of Lempira and residing in Copan, Father Milla stated that in the past he purchased chia from Nicaragua and sometimes from Mr. Narciso, but now he has planned to purchase directly from growers. Mr. Milla commented that he has been recommending chia to his patients with diabetes, nutritional deficiency, intestinal problems, and/or severe constipation throughout his 20 years in holistic healing. As mentioned in the literature review, many uses of chia are health and nutritional related like the ones stated by Mr. Milla. Most of his clients are less financially stable which includes people from rural areas but he does receive people who prefer a more holistic treatment to their illness. He also confirmed that an estimated 15,000kg of chia are bought per year and all of it is sold to homeopathic clinics. Mr. Milla mentioned that he has a 10 x 5 meter storage room with ventilation where he stores all his holistic medicinal ingredients, including chia.

Mr. Jose Narciso is considered the largest chia salesman nationally by volume. Mr. Narciso mentioned that he has been selling chia for over 15 years in Honduras and his costumers in a majority are homeopathic healers and doctors, as well as market merchants. Mr. Narciso used to purchase all of chia from Nicaragua and now hopes to be able to acquire more than 50% of his needed volume through local production. Currently he has been selling to local food services like super market and high end restaurants as he believes the educated population is being more aware of chia's healthy attributes. Mr. Narciso, middleman and chia expert, confirmed that he sells around 25,000kg of chia per year and he has always kept 12,500kg as back stock in his storage facility. This action he said is to mitigate price speculation and product scarcity, affirming once again on the price spikes mentioned by market specialist of USAID-ACCESO and other buyers, a decision influenced mostly by crop losses. Mr. Narciso confirmed that he owns his own warehouse with an approximate space of 20x15 meters, with proper ventilation and all his product sit on pallets.

According to all four purchasing agents interviewed, market demand is not met nationally and internationally. The Operational Manager of PROHGSA commented that Market demand within United States costumers had increased as he pointed out consumers became more aware of what they eat. All four purchasing agents interviewed also would like to obtain more chia product within the country, because of the higher quality.

Supply was met by importing chia from Nicaragua, since commercial Chia production in Honduras had not been done. As mentioned in the literature review Nicaragua greatly invested in post-harvest equipment and storage facilities for Chia. Thus, understanding that Nicaraguan production of chia had increased. As mentioned by Steven Daniel (2013) the growth rate Chia is having is exponential, with a registered growth of 239 percent between 2011 and 2012. Confirmed by USAID-ACCESO Department Manager, Mr. Valdivia, production in Lempira will be around 250 Ha with an estimated 800 Ha coming to production nationally for 2014/2015, further supporting what Mr. Daniels was predicting.

According to USAID-ACCESO's market specialist, Mr. Edgardo Varela, the market price at the time of sale (March-May 2014) was between \$5-7 per kg, with a peak of \$20 per kg towards the end of the season. The price attained was in accordance with the proposed price a US Importers/wholesalers suggested, \$5 per kg, suppliers to buy. Mr. Varela also commented on how this market price depends on the Nicaraguan harvest and storage quantity. This reinforces the literature review on Nicaraguan firms investing in chia processing and storage. According to Mr. Varela the last to date price of a 1kg of chia was \$2-3 per kg. Confirming the before mentioned production capabilities and market effect the southern hemisphere season has on the northern hemisphere producers and market, especially Mexico's second crop rotation.

The prices mentioned by Mr. Varela were confirmed by all purchasing agents interviewed as well as the dramatic spike occurred of \$20 per kg. This price spike in some way correlated with the literature review regarding the northern hemisphere production season and the small area dedicated in this hemisphere, which involved only 3 countries: Mexico, Guatemala, and Nicaragua. All these countries produce chia via small-scale farmers so production may not be as plentiful as the southern hemisphere market window, when all the large producers of Argentina, Australia, and Bolivia are active. Ones derived opinion on the production facts and

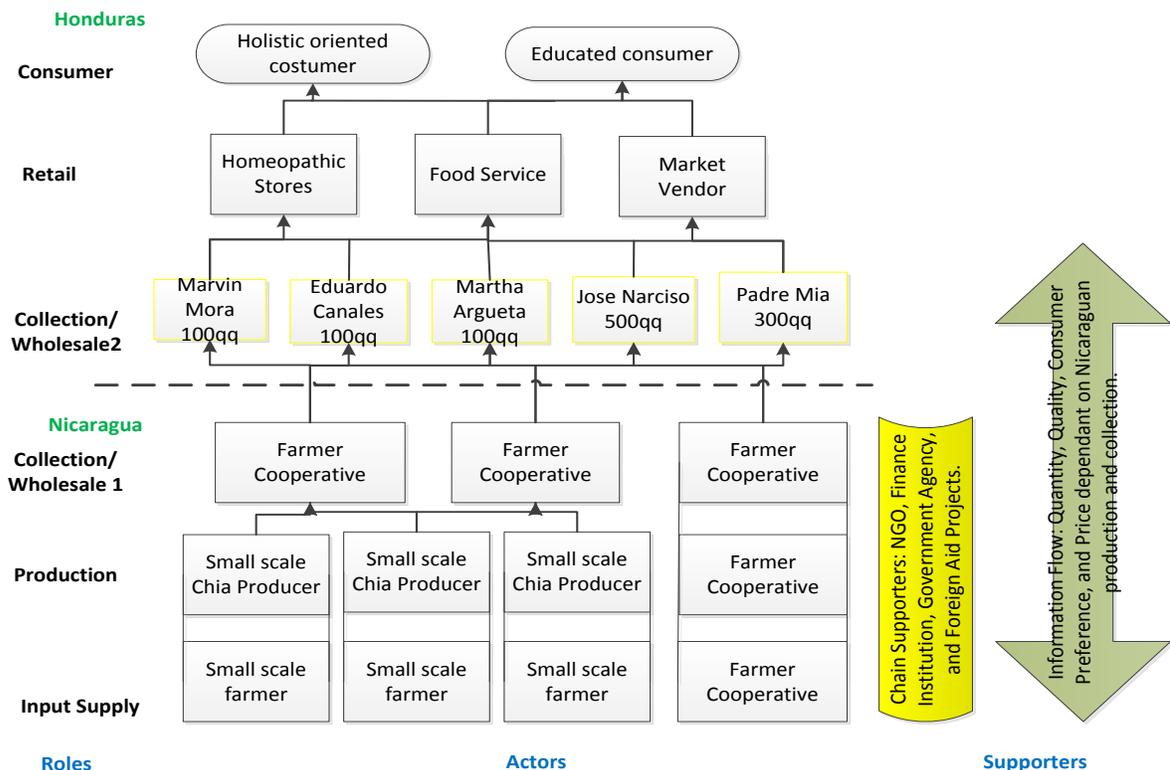
market windows is that a lot of room for speculation can be made and can directly have an effect on prices like the occurred price spike. If area of production is increased in the northern hemisphere one can speculate that prices will be stabilized.

4.11 THE CURRENT AND POTENTIAL CHIA VALUE CHAIN IN HONDURAS

Further analysing the results from the interviews with the purchasing agents and the USAID-ACCESO team one was able to identify two value chains, locally and internationally. Likewise, potential value chains were elaborated for the local and international market. These chains are based on Pre-USAID-ACCESO intervention and Post-USAID-ACCESO intervention.

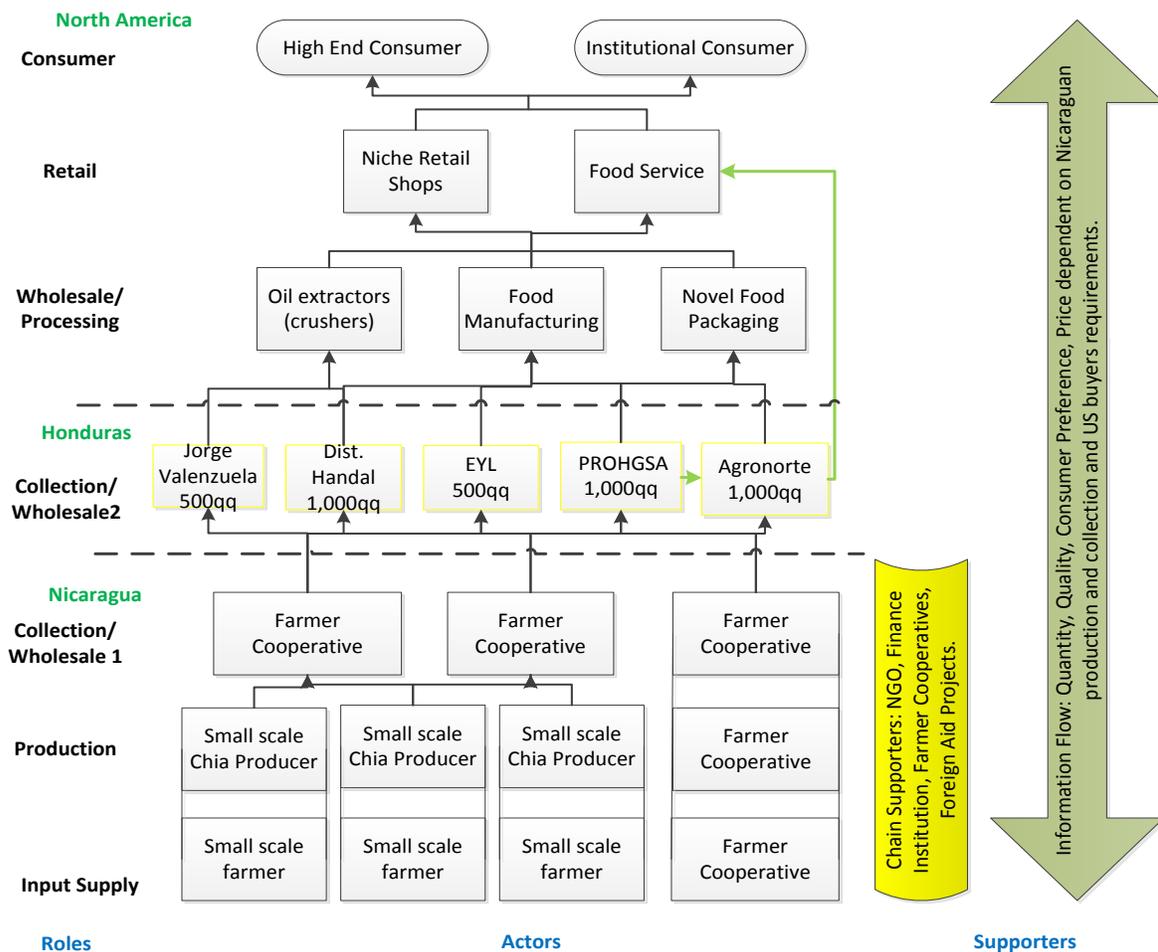
The present national value chain depicted all the national wholesalers obtained all their chia seed supply from Nicaraguan farmer cooperatives. Most of the Cooperatives would obtain their chia seed via small scale farmers in accordance to CECOOPSEMEIN RL agronomist, Mr. Felix Miranda's, observations in his production manual. This action of buying from wholesalers in Nicaragua created two stages in collection and wholesaling. The first collection and wholesaling was done in Nicaragua by the coops and second done by the wholesalers/middlemen in Honduras. Afterwards the different wholesalers would then sell two the three different retail actors identified: homeopathic/holistic stores and clinics, farmers' market vendors, and the food service industry (supermarket and restaurants). Based on the two local chia merchants, Mr. Fausto Milla's and Mr. Jose Narciso's observations the final consumer would be a holistic oriented consumer: people that could not afford modern medicine and/or people that opt for holistic wellbeing and Educated consumer who buy chia at the super market or can afford to go to high end restaurants. Not much is known about the chain supporters since USAID-ACCESO was not involved with chia before 2013. Information flow was limited and only between both Honduras and Nicaraguan wholesalers for price, quality, and quantity. Honduran wholesalers had no contact with Nicaraguan growers (See Figure 14).

Figure 14: National Chia Chain Pre USAID-ACCESO



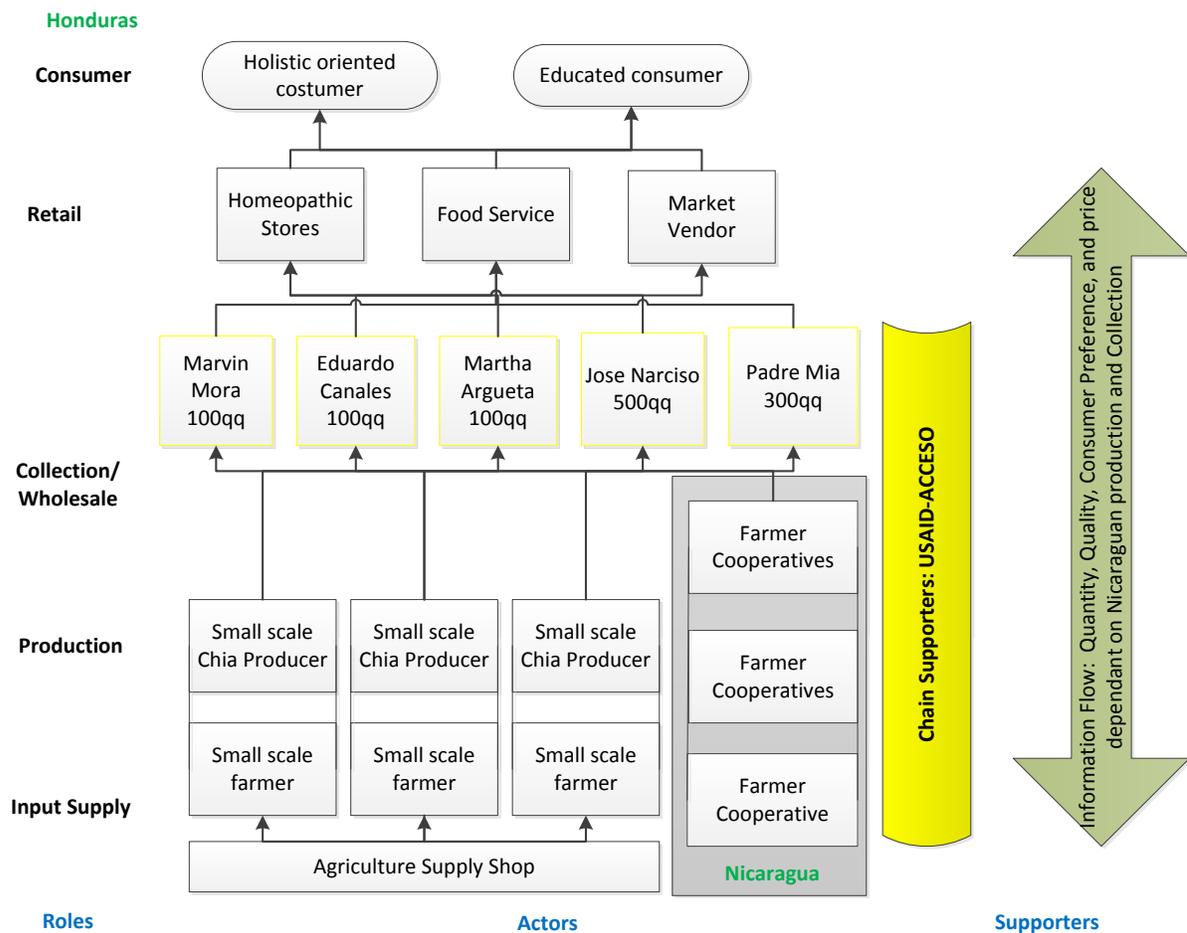
The present international chain was very similar to the national chain with exception of the market and final destination. National wholesalers obtained all their chia seed supply from Nicaraguan farmer cooperatives. Most of the Cooperatives would obtain their chia seed via small scale farmers in accordance to Mr. Felix Miranda's observations in his production manual for CECOOPSEMEIN RL. This action of buying from wholesalers in Nicaragua created three stages in collection and wholesaling. The first collection and wholesaling was done in Nicaragua by the coops, second done by the wholesalers/exporters in Honduras, and the third stage in North America. According to Mr. Jesus Nazarten of PROHGSA, of their 6 costumers, there was at least one of each three different industries listed suggested by the CBI market report on chia: Oil extractors, Food manufacturers, and Novel food packagers. USAID-ACCESO Market specialist, Mr. Varela, suggested that Agronorte may export chia in specially packed and labelled presentation to their food service costumers whom they are ready sell their specialty coffee as they have the necessary infrastructure. Little is known about the chain supporters in this chain do to the fact that the product would be only momentarily in Honduras before being shipped once again. The information flow is suggested to be both ways from consumer to grower for quality information, price, and quantity. Also from farmer coop to wholesale/ processing in the North America for quantity (See Figure 15).

Figure 15: International Chia Chain Pre USAID-ACCESO



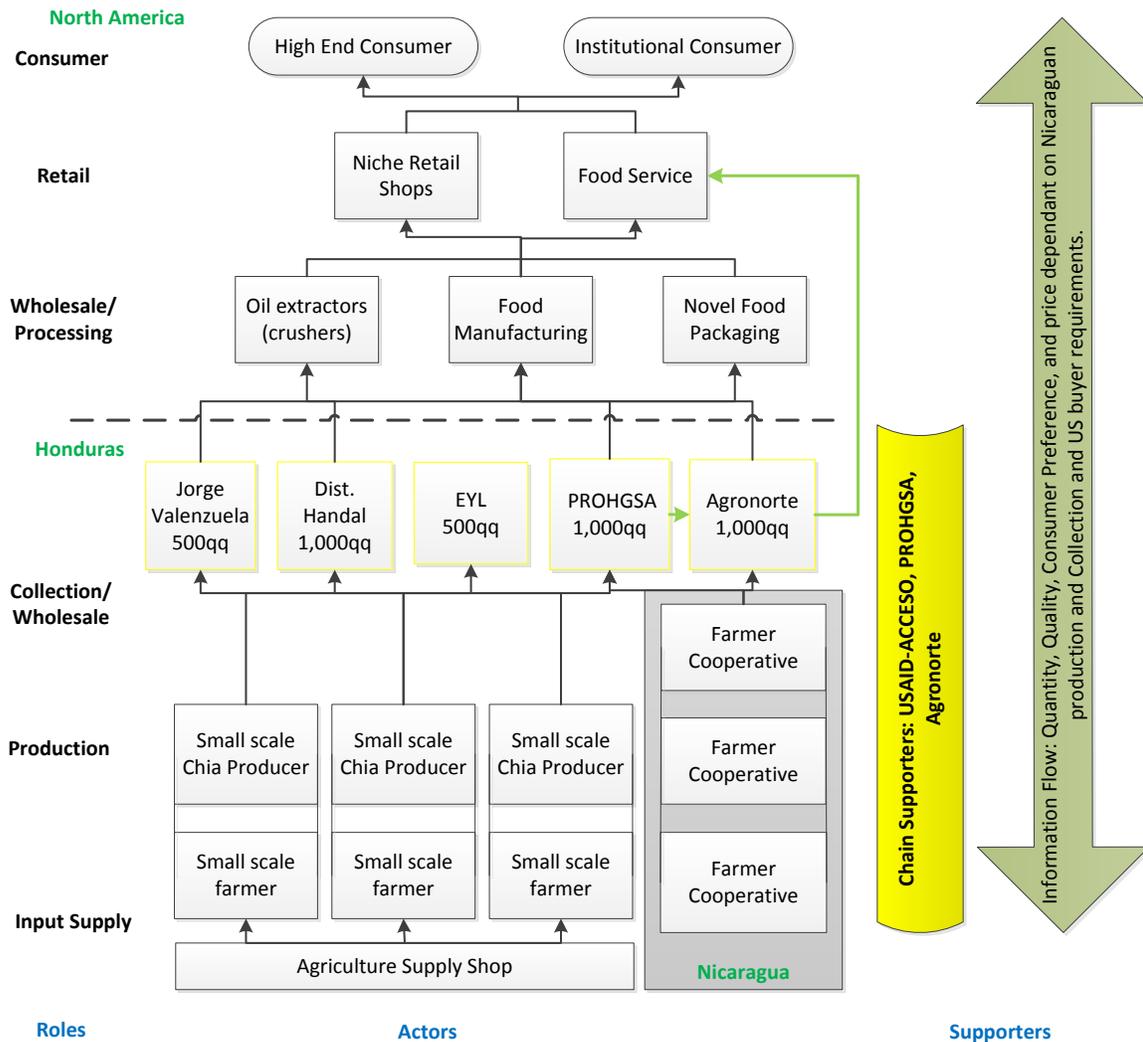
The potential national value chain post USAID-ACCESO intervention may have a drastic change since most of the chia seed supply can be obtained locally although not all. Therefore it is still feasible that the wholesalers/middlemen have still obtained seed from Nicaragua, suggesting it be the large farmer coops. Afterwards the different wholesalers would then sell to the three different retail actors identified: homeopathic/holistic stores and clinics, farmers' market vendors, and the food service industry (supermarket and restaurants). With USAID-ACCESO present farmers and wholesalers are supported by their technical and marketing team. The information flow is suggested to be from retail to farmer dealing with quantity and price, and from farmer to wholesaler dealing with quality and quantity (See Figure 16).

Figure 16: National Chia Chain Post USAID-ACCESO



The potential international value chain post USAID-ACCESO may have the same dramatic changes from the pre USAID-ACCESO. First most of the chia seed is supplied nationally although; it is still feasible that the wholesalers/exporter has still obtained seed from Nicaragua, suggesting it be the large farmer coops. Furthermore, collection/wholesale stages are reduced to two stages. The first stage of collection/wholesaling would be done in Honduras by the exporters and the second stage by the North American importer. Additionally in North America the chain structure would not change from the pre USAID-ACCESO chain. Another difference from the current chain is the supporters. The chain will be supported not only by USAID-ACCESO throughout all of the Honduran activities but private firms like PROHGSA and Agronorte are planned to enter in direct link with growers, something PROHGSA has already done. The information flow is suggested to be both ways from consumer to grower for quality information, price, and quantity. Also, information flow from farmer coop to wholesale/ processing in the North America for quantity (See Figure 17).

Figure 17: International Chia Chain Post USAID-ACCESO



4.12 THE CURRENT CHAIN RELATIONS BETWEEN ACTORS AND SUPPORTERS

Through the different interviews carried out between purchasing agents and USAID-ACCESO's Lempira team one perceived a proactive relation between the chain supporters and actors and between the different actors in Honduras. USAID-ACCESO was constantly and proactively providing different opportunities to small scale farmers whether it was via direct technical assistance, group assistance at model farms, and market linking for better opportunities. Similar can be said towards ACCESO's relation with the different buyers whether for local or international market. Market briefs were provided by USAID-ACCESO to the different buyers and field days were done with different purchasing agents in order to meet the growers and establish the market link.

According to the operational manager of PROHGSA, the company already has the support of sesame producers that can supply them with chia. As the wholesale firm this initiative provides extra security, especially for the small-scale farmers. Additionally, PROHGSA was looking to establish a collection centre either in Lempira or Intibucá. Such action would further strengthen the chain relation PROHGSA has with the farmers of the area. Local merchant, Father Fausto Milla, said he would attempt to have personal communication with the farmers of Lempira as he is native from the department and wants to build a closer relation with his suppliers. Such actions would create a symbiotic relation between both growers and buyers, as it would assure the market for the buyers and product for the purchaser.

The chain relation between Honduran exporters and North American importers was not deeply explored but one can assume that the relation was limited to information regarding price, quantity, and quality.

4.13 SUITABILITY TO SMALL SCALE FARMERS IN LEMPIRA

Chia is a market driven product and in 2012 it had a market of \$70 million. According to the literature review and results from the field study, Chia production has significantly increased, which suggests that the market has also grown. Chia seed was used for oil extraction in the omega 3 industries, which was estimated to be around a \$5.6 billion market industry.

According to the interviews with the USAID-ACCESO extension team, Chia needed low inputs for a successful crop to be established. Additionally, the survey extended to farmers affirmed that higher than normal yields were achieved, approximately 40kg per 450m² without irrigation. Chia presents low requirement in post-harvest management and the only caution needed in post-harvest handling is maintaining the seeds dry and away from water. Chia crop practices were similar to that of beans and harvested seeds can withstand rough handling. Weather in Lempira is extremely appropriate for the crop. Finally, favourable prices were achieved in the northern hemisphere.

5. CONCLUSION

Based on the results and discussion, the SWOT tool was used to derive a conclusion on chia's viability as a high value crop that meets the post-harvest demands of small-scale farmers in Lempira. Afterwards the type of chain governance will be defined to greater understand what value chain the chia crop would fall under.

Table 16: SWOT analysis of Chia Value Chain in Honduras for Lempira

Strengths	Weakness
<ul style="list-style-type: none"> • Market driven crop, provides more sustainable chain • High value crop • Market window is generous compared to southern hemisphere window. • Final seed product only needs protection from moisture and can handle existing logistical choices small scale farmers have • Proactive mid-level actors in the chain (Buyers) • Low input crop and hardy • Lempira's climate is ideal for chia production 	<ul style="list-style-type: none"> • New chain, experience is limited • Farmers past experience with other high value crops or new crops limits reception of new crops • Low investment in farm technology may hinder production • Lack of maintained infrastructure • Lack of transportation methods • Lempira is prone to hurricane damage
Opportunities	Threats
<ul style="list-style-type: none"> • Local market expansion and past holistic oriented consumers • The rise in interest by Institutional consumers like restaurants • New markets like Europe with EU-Central America free trade agreement • Cash crops like chia can motivate younger generations into farming and preventing them from migrating 	<ul style="list-style-type: none"> • Popular product today and not tomorrow (i.e. Noni) • Once USAID-ACCESO finishes chain may suffer from lack of support • Market competition with countries who have established chia chain already and control market price • Competition with narcotic crops like marihuana and poppy • Population migration and hinder future of agriculture

After analysing the value chains and actor relations, the chia crop falls into an Inter-firm value chain governance. According to USAID (2009) and inter-firm chain exists when some firms work to the parameters set by other powerful firms in the value chain. The firm that sets the parameters with which other firms in the chain must comply is referred to as the lead firm in the chain. Lead firms have the agency to choose and replace suppliers. In the case, of the chia value chain in Honduras the parameters are set by the importing firm in North America and the Honduran exporters adjust to those parameters, which can vary from quality, quantity, and price. As mentioned before, import firms suggest what prices suppliers should buy their chia, also demonstrating that they are the lead firm in the chain.

The type of inter-firm governance in the Honduran chia value chain is relational governance. Both the North American importer and the Honduran exporter rely on complex information that is not easily transmitted. An example can be market price, as a commodity item price can be set on pure speculation. This results in frequent interactions and knowledge sharing between parties, giving way to information being shared on local and regional production by the exporting firm to the importing firm and quality specifications from the importing firm to the exporting firm. High level of trust is needed in such firm and as mentioned in the interview results with the exporting firm, PROHGSA, they have contractual agreements with their buyers. Despite mutual dependence, lead firms still specify what is needed, and thus have the ability to exert some level of control over suppliers (USAID 2009).

6. RECOMMENDATION

In the following chapter recommendations are given to the problem owner, USAID-ACCESO, the farmers of Lempira, and the chia purchasing agents in Honduras.

The following recommendations are given to the problem owner, USAID-ACCESO:

- Do to the lack of government intervention and low reliability due to corruption it is suggested that USAID-ACCESO keeps focusing on market oriented crops with little post-harvest requirements, like chia. Such crops provide better sustainability for farmers and other members of the value chain. Market driven crops also help mitigate the drug crop breach in Lempira's farmers.
- Small-scale farmers in rural areas have a long history of failed attempts and unsuccessful market linkages, due to these past experiences it is recommended to approach farmers with caution, assuring their confidence and building a mutual relation with reliable buyers. Technical assistance to farmer groups is essential to gain a sense of comradery with peers, as well as verifying positive outcomes.
- In order to persuade farmers into producing new crops it is important to continuously extend demonstrative plots, introducing potential farmers to functioning production designs.
- Adding actors to further strengthen chain relation and function. Increasing the direct contact with buyers and growers may as well increase the likelihood of chain survival. Also, it can provide more motivation to the farmers knowing that their market is secured.

The following recommendation is given to the buyers/exporters of the chain:

- Gather all private enterprise involved in economic activities based in Lempira to pressure local, regional, and central government to provide some sort of maintenance to the current infrastructure. If a large group can come together, private pressure to the public sector can initiate some type of movement.
- Keep extending personal relationships with more farmers. This can assure greater chain success once supporters like USAID-ACCESO finish their project. Also, firms can assure product and keep farmers motivated. This in hand can develop mutual agreements and relation with farmers, which is preferred to contractual agreements. Such legal agreements have little to no relevance in Honduras as the legal system presents numerous flaws.
- Be loyal and fair with the growers as it is their main mean of income. Farmers had bad experience with buyers in the past. Keeping fair prices and loyalty will help prevent farmers from selling their product to other buyers.
- Provide farmers opportunities to grow other crops the company or merchant sells, for example sesame in the dry season.
- Establish private initiatives in social standards. Taking advantage of the chia production by small scale farmers to have a greater impact on the social wellbeing of the farmers and have the potential to achieve better market placement with non-legislative standards like Fair Trade.

The following recommendation is given to the small scale farmers in Lempira:

- Do not sell all their seed supply just because prices spiked like it was mentioned in the results. The chances that the farmers can be left with no genetic material for next year's season can occur.
- Chia farmers can dedicate certain areas of their farm to grow Chia just for genetic material or dedicate themselves just to grow chia for genetic material.
- Keep track at what the prices were the prior year at time of sale. This can help give price reference to current year but also can be compared to the price currently offered by the buyers. This can allow for negotiations for a better price for the farmers.
- Keep their chia seed properly stored for quality purposes and for genetic material for next year. It is essential farmers keep their final product and genetic material stored in a dry ventilated place to avoid any degradation on chia seeds.
- Have a good attitude towards production as bad attitude may lead to lazy and bad practices on the field. Also, to be patient when negotiating with buyers. This may lead to better price achievement.

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8. ANNEXES

ANNEX 1. NUTRITIONAL INFORMATION OF CHIA (Source: USDA 2014)

Source: USDA National Nutrient Database for Standard Reference 26 Software v.1.4			
Basic Report			
Report Run at: July 23		2014 09:05 EDT	
Nutrient data for: 12006,Seeds, chia seeds, dried			
Nutrient	Unit	1Value per100g	1.0"oz"28.35g
Proximate			
Water	g	5.8	1.64
Energy	kcal	486	138
Protein	g	16.54	4.69
Total lipid (fat)	g	30.74	8.71
Carbohydrate, by difference	g	42.12	11.94
Fiber, total dietary	g	34.4	9.8
Minerals			
Calcium, Ca	mg	631	179
Iron, Fe	mg	7.72	2.19
Magnesium, Mg	mg	335	95
Phosphorus, P	mg	860	244
Potassium, K	mg	407	115
Sodium, Na	mg	16	5
Zinc, Zn	mg	4.58	1.3
Vitamins			
Vitamina C, total ascórbico acid	mg	1.6	0.5
Thiamin	mg	0.62	0.176
Riboflavin	mg	0.17	0.048
Niacin	mg	8.83	2.503
Vitamin B-12	Âµg	0	0
Vitamin A, IU	IU	54	15
Vitamin E (alpha-tocopherol)	mg	0.5	0.14
Lipids			
Fatty acids, total saturated	g	3.33	0.944
Fatty acids, total monounsaturated	g	2.309	0.655
Fatty acids, total polyunsaturated	g	23.665	6.709
Fatty acids, total trans	g	0.14	0.04
Cholesterol	mg	0	0

ANNEX 2. DIFFERENT USES AND MARKETING



Source: Joseph Enterprises (2014)



Source: Mama Chia (2014)



Source: The Chia Company (2012)

ANNEX 3. CHIA PRODUCTION LARGE SCALE AT BENAXIA (Source: Benaxia 2013)



ANNEX 4. CHIA POST-HARVEST SEED EXTRACTION AND CLEANING (THRASHING) IN SAN SEBASTIAN, LEMPIRAS.



ANNEX 5. CHIA INVESTMENT PLAN (Source: ACCESO 2014)

Presupuesto para Producción de Chia

Area a Sembrar y Producción Esperada		Precio y Clasificación de la Producción			Venta Total		
Area:	0.06 Manzana	Porcentaje		Precio	L. 7,043.75		
	0.04375 Hectárea	Grado 1		L. 70.00	L. 7,043.75		
Rendimiento/Ha:	2,300 Libras	Grado 2			L. -		
Producción esperada	101 Libras	Grado 3			L. -		
		Descarte		L. -	L. -		

HECTAREA VARIABLE							
	Semana	Unidad	Unidades/ Ha.	Precio / Unidad	Costo por Hectárea	Costo por .04 hectarea	Unidades .04 hectarea
Preparación de Suelo					29,481.88	1,289.83	34%
MO Destrucción de Cultivo	-5	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
MO Limpia a Mano	-5	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
MO Preparación Tierra a Mano	-5	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
MO Aplicación de Cal	-5	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
Cal Hidratada	-5	QQ	23.00	112.00	2,576.00	112.70	1.01
Gallinaza	-5	Saco	32.00	35.00	1,120.00	49.00	1.40
MO Fertilizador a Mano	-5	Persona/Día	17.25	179.38	3,094.31	135.38	0.75
MO Acamado	-4	Persona/Día	34.50	179.38	6,188.61	270.75	1.51
Siembra					14,922.06	652.84	17%
Semilla *	0	Libras	3.00	100.00	300.00	13.13	0.13
Lorsban	0	Lt	1.00	330.00	330.00	14.44	0.04
MO Sembradores	0	Persona/Día	34.50	179.38	6,188.61	270.75	1.51
MO Aplicación	2	Persona/Día	17.25	179.38	3,094.31	135.38	0.75
MO Raleo	2	Persona/Día	23.00	217.79	5,009.14	219.15	1.01
Estaquillado					17,101.75	472.09	12%
MO Corte estacas	-3	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
MO Estaquillado	-2	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
MO Encordelado	-2	Persona/Día	8.00	179.38	1,435.04	62.78	0.35
Cabuya de uso único	5	Rollo	12.00	92.00	1,104.00	48.30	0.53
Control de Malezas					1,525.49	66.74	2%
MO Limpia a Mano	2 y 6	Persona/Día	23.00	179.38	4,125.74	180.50	1.01
Boa	0 y 12	Lt	6.00	110.00	660.00	28.88	0.26
Inex-A	12	Lt	0.24	170.00	40.80	1.79	0.01
Jrea Foliar	12	Kg	5.00	16.06	80.30	3.51	0.22
Bomba de Palanca	12	Bomba	8.00	3.36	26.87	1.18	0.35
MO Herbicida	12	Persona/Día	4.00	179.38	717.52	31.39	0.18
	0		0.00		-	-	0.00
Control de Plagas					1,034.31	45.25	1%
Karate Zeon	1 a 16	Lt	0.30	680.00	204.00	8.93	0.01
Inex-A	1 a 16	Lt	0.30	170.00	51.00	2.23	0.01
Bayfolan Forte	1 a 16	lt	2.00	145.00	290.00	12.69	0.09
	1 a 16		0.00		-	-	0.00
MO Fumigación	1 a 16	Persona/Día	2.00	217.79	435.58	19.06	0.09
Bomba de Palanca	1 a 16	Bomba	16.00	3.36	53.73	2.35	0.70
Fertilización					7,794.54	341.01	9%
18-46-0	1 a 16	QQ	4.00	620.00	2,480.00	108.50	0.18
Sulpomag	1 a 16	QQ	2.00	430.00	860.00	37.63	0.09
KCI Soluble	1 a 16	QQ	4.00	623.61	2,494.44	109.13	0.18
MO Fertilizador	1 a 16	Persona/Día	9.00	217.79	1,960.10	85.75	0.39
	1 a 16		0.00		-	-	0.00
Riego					13,495.89	590.45	16%
MO Instalar Sistema Riego	-3	Persona/Día	6.00	179.38	1,076.28	47.09	0.26
MO Recoger Cinta	20	Persona/Día	4.00	179.38	717.52	31.39	0.18
MO Regador	-3 al 20	Persona/Día	23.00	204.98	4,714.49	206.26	1.01
Distrito Riego Pago	-3 al 20	Mesual/Ha.	6.00	300.00	1,800.00	78.75	0.26
Cloro	1 a 20	Kg	4.00	59.40	237.60	10.40	0.18
Depreciación de Cinta/Ha	-3	Ciclo/Ha	1.00	3,300.00	3,300.00	144.38	0.04
Depreciación de Sistema	-3	Ciclo/Ha	1.00	1,650.00	1,650.00	72.19	0.04
MO Destrucción de Cultivo	0	Persona/Día	0.00	179.38	-	-	0.00
Indirectos							0%
MO Vigilante	0	Persona/Día	0.00	204.98	-	-	0.00

	Semana	Unidad	Unidades/ Ha.	Precio / Unidad	Costo por Hectárea	.04 hectarea	.04 hectarea
COSTO VARIABLE POR UNIDAD DE COSECHA							
Cosecha				3.43	7,897.28	345.51	9%
MO Corteros	18	Libras	2,300.00	0.6227	1,432.21	62.66	100.63
Transporte **	20	Libras	2,300.00	0.0200	46.00	2.01	100.63
MO Aporreando	20	Libras	2,300.00	0.7473	1,718.79	75.20	100.63
MO Cernido o Limpia	20	Libras	2,300.00	0.7473	1,718.79	75.20	100.63
MO Cernido o Limpia	20	Libras	2,300.00	0.6227	1,432.21	62.66	100.63
MO Empacador	20	Libras	2,300.00	0.3736	859.28	37.59	100.63
Plástico Normal	20	Libras	2,300.00	0.10	230.00	10.06	100.63
Sacos	20	Libras	2,300.00	0.20	460.00	20.13	100.63
TOTAL COSTO VARIABLE POR UNIDAD DE COSECHA				3.43	7,897.28	345.51	9%
COSTOS DE PRODUCCION					93,253.19	3,803.71	
COSTOS FIJOS							
Imprevisto	-3 al 9	%	1.00	-	-	-	0%
Administrativos	-3 al 9	%	1.00	-	-	-	0%
TOTAL COSTOS FIJOS					-	-	0%
GASTOS FINANCIEROS							
Financiero	Tasa	0%	Periodo	meses 4.00	-	-	0%
			Err:520				
TOTAL GASTOS FINANCIEROS					-	-	0%
TOTAL EGRESOS					93,253.19	3,803.71	
UTILIDAD PROYECTADA					67,746.81	3,240.04	

ANNEX 6. CURRENT ROAD MAP OF HONDURAS (Source: Nations Online Project 2014)



ANNEX 7. TOPIC LIST FOR USAID-ACCESO LEMPIRA EXTENSION TEAM

Interview ACCESO extension officer

Respondent's identification:

Name: _____ Gender: _____ Age: _____

Level of education: _____

Years working with the project: _____

Department and Municipalities Assigned: _____

Topics of discussion:

1. Frequency of visits to the same clients.
2. Services provided to client.
3. Constraints for small scale farmers in Lempira.
4. Chia Production
5. Chia cultivar potential for small scale farmers in Lempira.
6. Economic and cultural practice difference between farmers located in remote areas and farmers in more accessible areas of Lempira.
7. Role as a facilitator and communication with other stakeholders.
8. Constraints faced as extension officer.

ANNEX 8. TOPIC LIST FOR CHIA PURCHASING AGENTS IN HONDURAS

Interview Purchasing agent/exporter

Respondent's identification:

Name: _____ Gender: _____ Age: _____

Company name: _____

Product range: _____

Topics for discussion:

1. Purchasing price and selling price.
2. Volumes of Chia sold per year.
3. Experience with Chia and other products exported.
4. Current market for Chia seeds and potential market.
5. Market standards and Regulations.
6. Transportation used in Honduras and to final destination.
7. Current storage facilities in Honduras and post-harvest handling of Chia.
8. Market institutions with producers and client.

ANNEX 10. QUESTIONNAIRE FOR FARMERS IN LEMPIRA (SPANISH VERSION)

Encuesta a productores de Chía

1. Nombre: _____
2. Edad: _____
3. Sexo: F M
4. Número de integrantes de Familia: _____
5. Municipio: _____
6. Cuántos años lleva recibiendo asistencia de ACCESO?

7. Como mide la ayuda de asistencia técnica recibida por USAID ACCESO?
 MUY MALA MALA MAS o MENOS BUENA MUY BUENA
8. Tamaño de parcela: _____
9. Riego SI NO
10. Distancia entre la casa y parcela (Metros y Tiempo): _____ y

11. Distancia entre la parcela y calle más cercana (Metros y Tiempo): _____ y

- 12.Cuál es su costo de transportación para sus productos (Lempiras)?

- 13.Cuál es su método de transporte de la parcela a la calle? _____
- 14.Cuál es su método de transporte al destino final? _____
- 15.Cuál es su área total dedicada a la producción de Chía? _____
16. Ha tenido experiencia anteriormente con el cultivo de Chía? SI NO
17. Si la respuesta fue si, cuál fue el área sembrada _____ y cantidad
obtenida _____?
18. Cuantos ciclos lleva sembrando Chía?

19. Que otros cultivos siembra durante la temporada de Chía?

- 20.Cuál es su rotación de cultivo?

ANNEX 11. USAID-ACCESO LEMPIRA'S EXTENSION TEAM INTERVIEW TRANSCRIPTS

Mr. Ali Valdivia [Deputy (State) Production Manager USAID-ACCESO]

Mr. David Portillo [Senior Mentor Agronomists USAID-ACCESO (Zone Manager)]

Mr. Erick Meza [Senior Mentor Agronomists USAID-ACCESO (Zone Manager)]

Mr. Rene Carcamo [Senior Mentor Agronomists USAID-ACCESO (Zone Manager)]

Mr. Darvin Suazo [Senior Mentor Agronomists USAID-ACCESO (Zone Manager)]

Mr. Ali Valdivia, Age: 52, Male. Education: MSc. Plant Protection

Lempira has an extension team of one Deputy Production (State) manager, 5 Senior Mentor Agronomist (Zone manager), and 12 technical assistants, 1-3 per zone manager; this being a total of 18 on-field extension officers. 3 of the 4 Zone managers assisted producers with Chia. We expect all zone managers to have producers with Chia this growing season since the growing area will be around 250 Ha in Lempira and around 800 Ha nationally. The majority of the farmers are small scale, no bigger than 2,000 m². Their small farm size is the same reason why they can't obtain access to finance. Their property can't be used as a guarantee for a loan.

The level of agricultural practice really limits what crop they can produce and the yields they can obtain, but this is the reality these farmers live in. Still, we have to aid them in doing the best they can with what they have. We can teach them good cultural production and post-harvest practices and crops that can be successful and beneficial according to their circumstances

Vehicular transportation from the farms to the nearest town has its limitations. Most routes are dirt roads that are barely maintained by the government. Farmer access to roads is difficult thus getting their products out of the farm to the market and obtaining input supplies is problematic. The farmers lack financial capability to hire private means of transportation for their products and have to rely mostly on public transportation.

Chia has high potential in Lempira. We are achieving high yields and are aiming to increase our production per area. It has been able to handle post-harvest transportation without a problem and quality has been very good. It's the new in thing so we have to take advantage of the market. We plant in September to come out in January-February. Weeding is done within the first 3 weeks and then it is pretty much on its own. It is a very hardy and easy crop, just ants and slugs are pretty much the pest.

Mr. David Portillo, Age: 35, Male. Education: BSc Agriculture Production

Weekly on-farm technical assistance is given to farmers. Support is provided in production, post-harvest, and marketing. Obtaining financial aid is difficult because of farm size and no investment on farm for guarantees. Transportation was scarce in the remote region of Lempira because of the difficult terrain and the lack of maintenance on the existing after the rainy and/or hurricane season. The low level of agricultural practices limits their production. Chia has high yields in small areas and has very little requirements and pests. The climate of Lempira is more than adequate and transportation of the seeds is easy. Planting will occur in September and we will recommend the weeding during the first 3 weeks and advise farmers to be looking for cutter ants and slugs. Farmers in more remote areas have higher costs as they have to go into Gracias to buy inputs. Our role is to

teach farmers good agricultural practices, market oriented farming, and market linking. New crops are always difficult to introduce so production at the beginning is limited to small trial plots.

Mr. Erick Meza, Age: 38, Male. Education: BSc Agriculture Production

On-farm weekly individual or group assistance is given to the farmers. Support in GAP during production and post-harvest. Also, support in marketing and alternative crops is given. Sometimes after a good rainfall roads are inaccessible. We are not able to access the farms and the farmers the towns. Living in remote areas limits their access to financial institutions and with the farm being the only thing the farmers own it is difficult to obtain any financing. Narcotic crops are making their way into these areas too, since they have been forgotten by the government. Production practices are rudimentary and like mentioned before because of the remote location inputs are hard to obtain. We are now introducing the manufacturing of organic compost to establish a nutritional plan so the farmers do not rely on synthetic inputs and input store. Farmers here also have a higher cost than farmer closer to Gracias. New crops aren't always well accepted so small areas are dedicated at the beginning to get farmers in a more comfortable stage with the crop. Let them verify it is viable crop that has a market. With chia we are also to demonstrate that the product can handle with the post-harvest demands and has very little pests and requirements as well.

Mr. Rene Carcamo, Age: 44, Male. Education: BSc Agriculture Production

Frequency of visit is done weekly either individually or in a group. Services are provided in assistance during production, post-harvest, and marketing. Farmer's constraints are access to finance and having no viable guarantee for a loan as their farms are not considered a viable guarantee. Agriculture supply stores don't always carry everything in stock and farmers may find themselves short of necessary inputs. They also utilize very basic practices for production, very low investment. Chia is a hardy crop and has good market price. Farmers in accessible areas have a lower cost than remote farmers. The main constrain faced is getting the farmers trust to try out new crops like chia. Chia has good potential because of Lempiras climate and it grows like a weed with very little worry from pest and disease.

Mr. Darvin Suazo, Age: 41, Male. Education: BSc Agriculture Production

We give weekly technical assistance. Our services range from production, post-harvest, and marketing. Constraints they face are lack of stock by input supply, access to finance because of valid guarantees, and low technological input on farm. Chia is a very hardy crop that needs very little requirements. It has very little pest and Disease. Farmers who are living in more remote areas have higher input and output costs than farmers in accessible areas or near Gracias. Farmers are very wary of new crops. We had a new crop in the area, eggplant, that went well at the beginning but ended abruptly. The first couple of years the crop was very successful providing decent incomes for the farmers and an assured market with a proactive exporting firm. Unfortunately for the farmers in Lempiras the export firm found more products at a better price from Mexico and the eggplant production project got discontinued.

Annex 12. Honduran purchasing agent interview transcripts

Mr. Jesus Nataren (Operation Manager for export firm PROHGSA)

Mr. Gilberto Galo (Managing Sales Representative for export firm Agronorte S.A.)

Mr. Jose Narciso (Local purchasing agent/middle man)

Father Fausto Milla (Local purchasing agent/homeopathic practitioner)

Mr. Jesus Nataren (Operation Manager for export firm PROHGSA)

Purchasing prices are around \$4-7\$ per kg although prices can spike to \$20 a kg like it did in 2013. We are currently selling 1,000 qq of chia to the North American market, where we have 6 clients from the oil, food service, and novelty packagers. Market demand is raising because of more health oriented consumers. Currently we are getting our chia from Nicaragua. The company is dedicated to the export of allspice, black and white sesame, and chia. Mr. Nataren mentioned that he personally inspects seeds purchased at the market in Lempira and in occasions has travelled with USAID-ACCESO extension officers to meet with farmers who are currently growing sesame for PROHGSA. PROHGSA is looking into the viability of establishing a collection centre either in Gracias, Lempira or La Esperanza, Intibucá another department in Honduras to take advantage of local production and market demand of chia at the same time. PROHGSA facilities are located in Cortes where the chia is stored and shipped; he did not recollect the precise measurements of the warehouse, although he did state that the chia is packed in 50kg polypropylene sacks and then placed on pallets, pallet weight equivalent to 1 metric ton. Then they are shipped in dry containers via ship to the US.

Mr. Gilberto Galo (Managing Sales Representative for export firm Agronorte S.A.)

The company is dedicated to the export of specialty coffee, allspice, black and white sesame, and chia. He confirmed that Agronorte has contractual agreements to meet a quantity of 1,000 qq demanded by their consumers. Mr. Galo mentioned that the chia was picked up in the market of Gracias, Lempira, by their own means and brought to their storage and distribution centre in Francisco Morazán, the main department of Honduras, 6 to 9 hours from production grounds, for inspection and shipment. He seemed very hesitant in his answers and was reluctant to provide further information and the interview terminated.

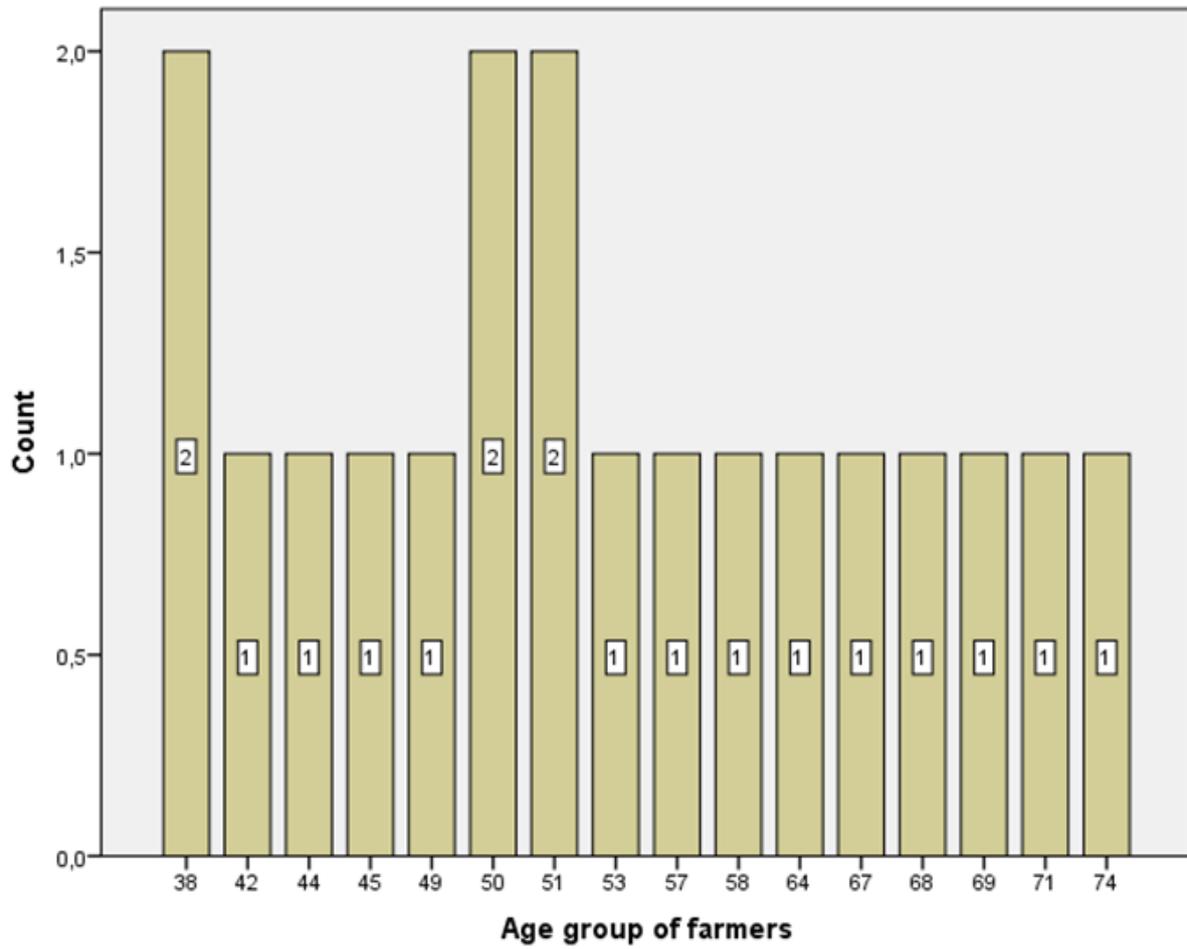
Mr. Jose Narciso (Local purchasing agent/middle man)

Mr. Narciso mentioned that he has been selling chia for over 15 years in Honduras and his costumers in a majority are homeopathic healers and doctors, as well as market merchants. Mr. Narciso used to purchase all of chia from Nicaragua and now will buy from Honduras production, which he stated was coming out very good quality seed. Prices vary from L40-70 but in 2013 prices reached to \$1,000 per 1 qq. currently he has been selling to local food services like super market and high end restaurants as he believes "the educated population is being more aware of chia's healthy attributes." Mr. Narciso, middleman and chia expert confirmed that he sells around 500 qq of chia per year and he has always kept 250 qq as back stock in his storage facility. This action he said is to mitigate price speculation and product scarcity, a decision influenced mostly by crop losses. Mr. Narciso confirmed that he owns his own warehouse with an approximate space of 20x15 meters, with proper ventilation and all his product sit on pallets.

Father Fausto Milla (Local purchasing agent/homeopathic practitioner)

Mr. Milla is a Roman Catholic priest that for over 20 years has been dedicated to homeopathic medicine and holistic healing in Honduras. Father Milla stated that in the past he purchased chia from Nicaragua and sometimes from Mr. Narciso at a price of around L40-70 a pound. Mr. Milla commented that he has been recommending chia to his patients with diabetes, nutritional deficiency, intestinal problems, and/or severe constipation throughout his 20 years in holistic healing. Most of his clients are less financially stable which includes people from rural areas but he does receive people who prefer a more holistic treatment to their illness. He also confirmed that an estimated 300 qq of chia are bought per year and all of it is sold to homeopathic clinics. Mr. Milla mentioned that he has a 10 x 5 meter storage room with ventilation where he stores all his holistic medicinal ingredients, including chia. Transportation of the product is done by pick-up trucks.

ANNEX 13. TOTAL FARMER GROUP AGE



ANNEX 14. BENEFIT-COST RATIO FOR IMPORTANT STAPLE CROPS MAIZE AND BEANS

Corn with Irrigation (1 Ha)

Profit	L 52,800
Total Cost	L 37,913
Net Profit	L 14,887
Cost-Benefit Relation	1.39

Corn without irrigation (1 Ha)

Profit	L 6,006
Total Cost	L 19,737
Net Profit (Loss)	-L 13,731
Cost-Benefit Relation	0.30

Red Kidney Bean with irrigation (1 Ha)

Profit	L 64,064
Total Cost	L 41,858
Net Profit	L 22,206
Cost-Benefit Relation	1.53

Red Kidney Bean without irrigation (1 Ha)

Profit	L 34,434
Total Cost	L 26,285
Net Profit	L 8,149
Cost-Benefit Relation	1.31

ANNEX 15. AGRONORTE FACILITIES, FRANCISCO MORAZAN, HONDURAS. (Source: Agronorte 2009)

