

# **BUENO ES CULANTRO, PERO NO TANTO:**

*A Social, Environmental and Financial Review of Culantro Production in the Chepo Area*



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**Presented to:**  
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## Executive Summary

The rainforests of Panama are greatly threatened by agricultural preparatory and land management techniques. Deforestation associated with slash and burn, also known as, shifting cultivation can be extremely detrimental, resulting in secondary forests of little biodiversity and rapid loss of nutrients from the cycle through leaching (Lawrence, et. al. 2007). Deforestation is one of the largest global greenhouse gas contributors in the tropics, an area that has huge implications for global carbon storage in its rich, dense jungles.

The agricultural practices that are most prolific in feeding this rapid deforestation are cattle grazing, although large cereal crops require significant spreads of land with intensive inputs as well. Our research focuses on the cultivation of culantro in small rural communities north of Chepo in eastern Panama Province, Panama. Culantro is culturally an important herb throughout Central America, widely used in regional cuisines and even used by small rural and indigenous populations medicinally as a mild local anesthetic.

Culantro is not a large-scale endeavor in the studied areas but is the most important form of income for inhabitants of the two study towns. The culantro farmers do slash and burn forest to clear land for culantro cultivation, often unaware of the negative effects of doing so. CREA, along with a handful of NGOs in Panama, is interested in the effects of small-scale agriculture on surrounding forest and the potential monetary offsets that could be applied to curb these effects. There has been talk of implementing an avoided deforestation credit program as part of a greenhouse gas emission reduction initiative in which farmers would be monetarily compensated for the land that they leave as forest without cultivating.

Up until now there has been little formal research on culantro and consequentially little is known about it. We have attached a literature review pertaining to surrounding topics (i.e. carbon credits, tropical deforestation, small holder farm environmental effects) due to the gap in literature, there is little information about culantro itself.

The aim of this study was to determine the social, environmental and financial implications of culantro cultivation in two small agricultural towns, El Valle de Madroño (15 km from Chepo with access to public transport) and La Zahina (5 km further away from El Valle de Madroño with no access to public transport). For this study informal interviews were carried out with 9 farmers in the two areas; 4 from El Valle de Madroño and 5 from La Zahina. Additionally, people involved in the transport of culantro were interviewed as well as vendors in 3 major markets in Panama City. Once information was gathered an in depth financial analysis was conducted on two farms from each study site.

In terms of social conclusions drawn it was determined that both towns had only been created about 40 years ago from people immigrating from the provinces of Veraguas and Chiriquí. The majority of people in both towns generated the bulk of their income from culantro farming. In terms of environmentally related conclusions, there was extensive pesticide use in both towns with some farmers spraying up to 3 times a week to combat pests. Also, there was some misdiagnosis of pest problems noted since in some cases farmers were using fungicide to treat caterpillar problems. Farms are in general 0.25 to 0.50 hectares big and culantro is grown on the same piece of land for anywhere between 1 to 4 years before the patch is abandoned or used to grow other

crops. There are many ways of growing culantro and there were significant differences between the two towns, despite the fact that they are only 5 km apart. In La Zahina the most popular form of cultivation was either an open field, or intercropped with plants such as cassava or plantain. In El Valle de Madroño one farmer chose to grow it in beds, with the other three growing it in an open field setting.

The bulk of the report was focused on the financial implications and the state of the forest in the area. The in depth financial analysis on the four farms chosen indicated that the annual income of farmers varied between \$1000 and \$4000. This large difference in incomes is due less to the differences in amounts sold at market, but to amount of inputs purchased. Farmers sell on average 2 sacos per week, each of which contain 5 docenas of culantro. Farmers spent anywhere from \$0.00 to \$23.00 per week on transport, the highest overall expense, to bring their culantro to market in Panama City. Other major expenses include labor, since a day laborer charges \$1.80 to harvest 1 docena. Also, farmers were spending between \$50.00 to \$850.00 annually on inputs such as pesticides and fertilizer. In general, the biggest complaints voiced by the farmers were the fluctuating market prices of culantro (between \$5.45 and \$10.58 per docena in 2007) and the poor quality of the road and transportation systems.

Since the amount of land used to grow culantro is relatively small compared to other activities such as cattle farming, the threat to the forest is not very high. At least 6 of the 9 farmers interviewed had half or more of their land in forest, although the quality of forest was not known. Also, 4 of the 9 farmers had knowledge about the positive benefits of the forest on surrounding agricultural land.

Given the elusive nature of the plant we have found an immense amount of information through the research. We hope that this information can be useful in assisting future research on culantro. We especially hope that the financial information will shed light on, and assist any organization (governmental or non) that wish to apply an avoided deforestation credit program in the future.

## Resumen Ejecutivo

Las selvas tropicales están muy amenazadas por la agricultura y las técnicas de manejo de la tierra. La deforestación asociada con la agricultura de ‘tala y quema’ puede ser muy perjudicial y como resultado se forman bosques secundarios de pobre biodiversidad con pérdida de nutrientes por filtración fuera del sistema del suelo. La deforestación es uno de los contribuyentes que aumenta los gases de invernadero en la atmósfera en la región tropical. Esta región tiene implicaciones profundas en la absorción del carbono en sus selvas.

Las prácticas agrícolas que más contribuyen a la deforestación están asociadas con la ganadería. Sin embargo, el cultivo de cereales necesita también bastante espacio con muchas inversiones. Nuestra investigación se concentra sobre el cultivo de culantro en dos pueblos pequeños rurales al norte de Chepo en el parte este de la Provincia de Panamá, Panamá. Culantro es una hierba que se utiliza en la cocina y medicinalmente en Centro América.

Culantro no es un cultivo extenso, pero, es la principal fuente de ingreso en los dos pueblos incluidos en el proyecto. Los campesinos que cultivan culantro, por lo general, utilizan el método de ‘tala y quema’ para preparar la tierra, frecuentemente sin conocimientos de los efectos negativos. CREA, junto con algunas otras ONGs en Panamá, están interesados en los efectos de la agricultura en pequeña escala sobre el bosque y sus alrededores y un programa potencial de incentivos para cuidar el bosque. Este programa sería parte de una iniciativa para reducir la cantidad de gases invernadero que incluye pagar dinero a los campesinos por cuidar el bosque que queda en su tierra.

Hasta ahora hay pocas investigaciones científicas sobre culantro y por consiguiente hay pocos conocimientos. Incluida en la investigación esta una revisión de la literatura pertinente a los sujetos relacionados (por ejemplo créditos de carbono, deforestación tropical, efectos ambientales de fincas de pequeño tamaño). Desafortunadamente hay poca información sobre la planta de culantro.

El objetivo de este estudio es determinar las implicaciones sociales, ambientales y financieras de la producción de culantro en dos comunidades pequeñas cerca de Chepo; El Valle de Madroño (15 km de Chepo con servicio de chiva) y La Zahina (5 km de El Valle de Madroño sin servicio de transporte). Hemos completado entrevistas informales con 9 campesinos, 4 en El Valle de Madroño y 5 en La Zahina. Adicionalmente se entrevistó a trabajadores involucrados en el transporte de culantro y a vendedores en 3 mercados en la Ciudad de Panamá. Con la información colectada se hizo un análisis financiero profundo de 4 fincas.

En el tema social, hemos descubierto que los dos pueblos tienen poblaciones de Chiricanos y Veragüenses que se trasladaron hace 40 años. La mayoría obtiene sus ingresos del cultivo de culantro. En el tema del medio ambiente, había uso extensivo de pesticidas en los dos pueblos y algunas veces lo usan 3 veces a la semana. Había también algunos malos diagnósticos de las plagas, por campesinos que utilizan fungicidas para tratar los problemas de gusanos. Por lo general las fincas son de un tamaño de 0.25 a 0.50 hectáreas y el culantro se cultiva en la parcela durante 1 a 4 años antes de que se cambie de parcela. Había bastantes maneras de cultivar culantro y había diferencias grandes entre

los dos pueblos aunque están solo 5 km aparte. En La Zahina la principal manera de cultivo es en el campo abierto o con otras plantas (por ejemplo yuca o plátano). En El Valle de Madroño un campesino ha cultivado con sistema de camas, pero los otros 3 han cultivado en el campo abierto.

La mayoría de la investigación fue hecha sobre el aspecto financiero del cultivo del culantro. Los análisis profundos de las 4 fincas han mostrado que los campesinos tienen un ingreso de aproximadamente \$1000 - \$4000 dólares por año. Esta diferencia es como consecuencia no del número de sacos llevados al mercado, pero si la cantidad de inversión utilizada en la finca. Por lo general, los campesinos venden 2 sacos por semana que tiene cada uno 5 docenas de culantro. Los campesinos gastan de \$0.00 a \$23.00 cada semana por el transporte, este es el principal gasto. El segundo gasto principal fue los peones porque ellos están pagando \$1.80 por cosechar una docena. El tercero gasto principal fue los químicos, por ejemplo los pesticidas y abonos. Los campesinos gastan entre \$50 - \$850 cada año por gastos en químicos. Las quejas principales de los campesinos son el precio fluctuante del culantro en el mercado (que está entre \$5.45 y \$10.58/docena en 2007) y la mala calidad de la carretera y el transporte.

Como el tamaño de las fincas es pequeño, la tala del bosque por culantro no es muy alta comparada con otras actividades como la ganadería. La mayoría de los campesinos tienen la mitad de su tierra en bosque, pero no tenemos conocimientos de la calidad. Aproximadamente la mitad de los campesinos han tenido algún conocimiento de los beneficios de tener bosque alrededor de la tierra agrícola.

Dada la falta de conocimientos sobre culantro hemos desarrollado una cantidad muy amplia de información. Esperamos que esta información se puede utilizar en investigaciones sobre culantro en el futuro. Esperamos también que esta información pueda ayudar a organizaciones a crear programas de incentivos por cuidar el bosque.

## TABLE OF CONTENTS

Title Page.....	i
Executive Summary.....	ii
Acknowledgements.....	vii
Host Institution Information.....	viii
1. Introduction.....	1
1.1 Background.....	1
1.2 Questions and Objectives.....	3
2. Literature Review.....	4
3. Methodology.....	8
3.1 Farm Visits and Interviews.....	8
3.2 Outline for Informal Interviews.....	10
3.3 Vendor Interviews in Panama City.....	10
4. Results.....	11
4.1 Culantro: General Information Gathered from the Field.....	11
4.2 Interviews and Farm Visits.....	12
4.3 Annual Financial Summaries.....	24
4.4 Monthly Financial Summaries Graphing High & Low-Input Culantro Cultivation.....	25
4.5 Vendor Interview Results.....	26
5. Discussion.....	28
5.1 Comparisons between El Valle and La Zahina.....	28
5.2 The Forest.....	32
5.3 Motivation.....	34
5.4 Contracts and Price Fluctuations.....	36
5.5 Transport.....	40
6. Recommendations and Conclusions.....	41
6.1 Environment.....	42
6.2 Society.....	43
6.3 Finance.....	43
6.4 Final Recommendations and Conclusion.....	44
7. References.....	46
Appendices.....	48
Appendix 1: Interview Outline.....	49
Appendix 2: Pictures.....	50
Appendix 3: Work Schedule.....	53
Appendix 4: Budget.....	55

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CREA, an acronym for Conservation through Research, Education and Action, is a non-profit organization registered in Panama, the United Kingdom and the United States. CREA was founded in 2003 by executive director Michael Roy, with the intention of spreading knowledge about environmentally sustainable choices, so as to better the quality of life through improved environment for generations to come. CREA's Panamanian office is located in the Ciudad Del Saber and run by its two directors, Michael and Anita Roy. The organization is currently composed of both Michael and Anita, as well as Maaike - director of programs, Carmen - office secretary and Becky and Danielle - two field assistants.

With the help of various private funding, CREA works towards its goal of protecting rainforests from destruction by development and agriculture, while prioritizing the well-being of the people living in and around these forests. CREA works with local communities in the El Valle de Madroño region, holding workshops and organizing projects geared towards the protection of the surrounding forest and the betterment of local's lives. CREA has also offered undergraduate conservation and sustainable development courses, and has hosted environmental education camps for youth.

The organization has recently acquired the Cocobolo Nature Reserve, 1000 acres of primary and secondary growth forest located in the district of Chepo, neighboring the Kuna Yala Comarca. The nature reserve is to be used as a base from which to develop sustainable educational tourism opportunities for families, groups and schools. The reserve is also used as a farmer to farmer training facility, working with the surrounding communities to teach low impact farming practices to local campesinos.

## 1. INTRODUCTION

### *1.1 Background*

Panama is a country rich in natural and cultural beauty, yet dotted with rapid development, environmental degradation, and great social disparities (Fisher and Vasseur 2000). With increased development so has come the rapid destruction of surrounding rainforests, an important source of food and material resources to the human populations, and habitats for the wildlife populations of the country. Forests are being compromised for urban sprawl and agricultural land around the large cities and rural areas of Panama, respectively (Heckadon-Moreno 1985). In the case of expanding agriculture, forest loss is often a result of improper land management and inefficient practices (Fisher and Vasseur 2000).

The El Valle de Madroño region of Panama Province is a patchwork of sparsely populated agricultural land and tropical rainforest. The valley has been inhabited by agriculturalists for the past 40 years, slowly growing in population, consequentially leading to the clearing of forest for pasture and field crops. While cattle ranching takes up the largest amount of land and is arguably the most environmentally degrading agricultural practice in the area, food crop cultivation is largely practiced as well, both for personal consumption and commercial sale. Cattle ranching in the area is dominated by a few large land owners, whereas subsistence crop production is practiced by many small land owners as well as people renting land. The two towns used in this study were El Valle and La Zahina, both of which are located in the El Valle de Madroño region and rely heavily on the commercial sale of culantro (*Eryngium foetidum*) for a consistent income (*Pictures 1 & 2*).

Culantro is a biennial herb indigenous to continental Tropical America and the West Indies (Ramcharan, 1999). Culantro is in the same family (Apiaceae) and quite similar to cilantro (coriander) in odor and taste, though it is in fact a different genus and species with a physical appearance quite distinct from its distant relative. This herb is grown throughout Central America and the Caribbean and is a cornerstone to many traditional meals of these regions. The herb is grown throughout Panama, in the Coclé, Chiriquí and Darien Provinces, as well as the area surrounding Chepo (El Valle de Madroño). While the plant is infrequently exported, it is sold in abundance in local markets, making it a cash crop for many small farmers in the aforementioned areas.

In the two focus towns of this report over 50% of family income came from the cultivation and sale of culantro, and nearly everyone grows culantro on some scale. Land used for culantro production is traditionally prepared through slash and burn methods, requiring the destruction of a parcel of primary or secondary rainforest, followed by heavy use of chemical fertilizers. These methods provide fast and easy ways of growing the crop in abundance, but are often inefficient for the amount of culantro being produced. Culantro seeds are commonly broadcasted on fields and in some cases are managed rather infrequently with a lackadaisical attitude toward field organization and cleaning. Alternative methods, such as organic fertilizers, extended fallow times and bed cultivation could be substituted for traditional methods to increase soil fertility and extend future cultivation of the crop, while producing the same amount for market sale.

As of now the perceived motivation within these communities to grow culantro is largely unknown. The economic incentives to grow this crop seem small after accounting for labor, transportation, chemical inputs and the damage done to the land. While the

environmental effects seem to be vast, they are not well known. There is currently very little literature on the cultivation of culantro and it is therefore difficult to know just what the costs and benefits of this crop are.

Small-scale rural agriculture is usually a struggle between land upkeep and putting food on the table to feed one's family, often appropriately categorized as a hand-to-mouth lifestyle (Paarlberg 1994). In this lifestyle it is often hard to look far into the future because present goals, such as providing a meal for dinner, outweigh any future planning abilities. This urgent cycle can also cloud the realities as to what sort of monetary and physical inputs are going into a crop. Culantro farmers may be quite similarly unaware of the expenses going into labor, transportation and chemical inputs of the crop, therefore neglecting the actual profit of this lifestyle.

### *1.2 Questions and Objectives*

The main question behind the efforts of this research is: What are the social, environmental and financial implications of the cultivation of culantro in the El Valle de Madroño region of Panama Province, Panama?

The objectives of this project are twofold. Firstly, to gather and disseminate information pertaining to the social and environmental aspects of culantro cultivation in the El Valle de Madroño region of Panama. As of now there has been no formal research on the crop and very little is known about the nature of its cultivation. This information can be useful to future researchers and agriculturalists alike.

The second objective is to have the farmers of La Zahina and El Valle de Madroño think more critically about the crops they are producing and what exactly the returns are. This will be accomplished through an annual financial analysis of chosen

farms from each town visited throughout the course of the field work. Due to farmers' financial status, more importance is placed on short term gain, however, this type of planning can lead to serious problems. By asking detailed questions about the positive and negative aspects of culantro as a crop, farmers may take a more long term view of agricultural production to make more informed choices in the future.

The financial information may also be a potential resource for the future implementation of programs aimed towards giving monetary incentives for avoided deforestation (AD). In the past, reforestation projects have been sponsored by governments and NGOs as a way to reclaim cleared land, however, only recently has the idea of pay outs for keeping private land forested taken shape. As climate change becomes a more and more difficult problem to deal with, high return cost effective ways of reducing emissions are gaining popularity. According to Stern (2007) AD is a low cost way to quickly reduce emissions. Already there is talk amongst farmers of La Zahina about the possible creation of such programs, discussed with enthusiasm throughout the community.

## **2. LITERATURE REVIEW**

According to the IPCC (2001) deforestation as a result of land use change is the second largest global greenhouse gas contributor after fossil fuels. Of those emissions related to agriculture, one third is estimated to be due to land clearing, most notably deforestation in the tropics (Fujisaka et al. 1998). Deforestation alone is estimated to release between 1.5-3 Gt of C per year in the form of CO<sub>2</sub>, roughly 10-14% of global C emissions (Fujisaka et al. 1998).

Latin America, along with having some of the most ecologically significant remaining rain forests, also has some of the highest rates of deforestation. For example, the Amazon basin, which includes approximately 60% of the world's tropical rain forests, is being deforested at the rate of 2 million hectares per year, the highest rate of absolute deforestation in the world (Laurance et al. 2002). In Panama, much of the deforestation seen throughout the country is a result of slash and burn agriculture (Tschakert et al. 2006; Fisher and Vasseur 2000).

Slash and burn agriculture is a practice that has been used in Panama and other Latin American countries since 5000 BC by indigenous populations (McKay 1990). It is typically characterized by smallholder farmers who clear forest in order to grow crops on the land. The theory behind the practice is that the nutrients contained in the above ground biomass, when burned, increase the fertility of the soil and become available to plants that are grown on that piece of land afterwards (Palm et al. 1996). Also, the increase in temperature causes an increased rate of decomposition of organic matter and litter on the surface (Palm et al. 1996).

Traditionally fallow periods in slash and burn agriculture are between 12 and 20 years (Joly 1989). Land scarcity in Panama is now causing fallow times to be reduced. Although slash and burn agriculture can be appropriate if done properly, it can become extremely destructive if used excessively or without leaving time for re-growth to occur (Collins 1995). Currently, 24% of land in Panama is protected, with another 24% under the control of indigenous populations (Fisher and Vasseur 2000). Additionally, 22.6% of land is classified as degraded or abandoned, meaning that it is no longer suitable for

agriculture (INRENARE 1995). This only leaves a small portion of land available relative to the population size.

Having to produce the same amount of food on a smaller area of land has left farmers with two options; bring more land under production or shorten the fallow periods in their slash and burn practices. This dilemma, confounded with other problems has caused the rate of deforestation in Panama to reach a high of 51,000 ha/year in 1995 (INRENARE 1995). The majority of this deforestation occurred on the colonization frontiers. The Chepo region of Panama is a recently colonized area, with people beginning to move there as a result of the construction of the Bayano Dam in the 1970s (Wali, 1993). When land becomes too scarce, or too depleted, in interior provinces families begin moving to colonization frontiers in search of a better life. Agricultural land is established in these new areas and large amounts of deforestation occur.

Heckadon-Moreno (1985) explains that when colonizers first move to an area they are extremely dependant on natural resources. Once access roads are built the population begins to grow rapidly and deforestation is extremely prevalent. Collins (1995) explains that colonists often use a trial and error method to determine the best management strategy for the new land. However, the rapidly changing environment and strong land pressure make this strategy ineffective. To exacerbate matters, government and institutional policies often encourage deforestation and promote unsustainable land use practices (Collins 1995, Geist et al. 2002)).

Given the level of poverty that most colonists are at, Paarlberg (1994) explains that many cannot wait for resource conserving methods to pay off and do not have the capital to make large investments into soil conservation. Eventually the lands become so

degraded that yields decline and they are no longer able to meet their subsistence agriculture needs and they continue the cycle of exploitation and abandonment (Collins 1995, Heckadon-Moreno 1985).

There are many suggestions for how to deal with the problem of deforestation while optimizing the opportunities of both the farmers and the quality of the forest. These solutions include better soil management practices and improved development policies. Recently, avoided deforestation (AD) payments have evolved as a way to provide a supplemental income to farmers to allow them to keep parts of their land forested. AD is a term which refers to a system in which governments or other institutions give out payments to individuals to keep the forest intact on their land. In the past reforestation projects have been sponsored by governments and NGOs as a way to reclaim cleared land, however, only recently has the idea of pay-outs for keeping private land forested taken shape. As climate change becomes a more and more difficult problem to deal with, high return cost effective ways of reducing emissions are gaining popularity. According to Stern (2007) AD is a low cost way to quickly reduce emissions. While there is no current structure in place in Central America, private institutions and NGOs are beginning to explore the possibility of privately funding AD programs. Isenberg and Boileau (2007) concluded that at this time an AD program sponsored by the government is “economically feasible, but politically impossible”.

### 3. METHODOLOGY

#### *3.1 Farm Visits and Interviews*

This research was based upon two five-day visits to the El Valle de Madroño region, in which the towns of El Valle de Madroño and La Zahina were visited. The research conducted in El Valle de Madroño was gathered from the 8<sup>th</sup> to the 13<sup>th</sup> of March, 2008, while the research in La Zahina was carried out from April 8<sup>th</sup> through to the 12<sup>th</sup> of 2008. In this region the dry season typically begins in December or January and ends in April, with the wet season beginning at the end of April and continuing through to December (Becker et al. 1988).

The visits involved a two-part data collection method in which informal interviews were conducted, in accordance with the McGill University and Smithsonian Tropical Research Institute's code of ethics. These interviews, conducted in Spanish, took place at the farmers' home, lasting between one and two hours each and based on the questions in *Box 1 (appendix 1)*. The second part of the data collection was observational, based on visits to the farms of the interviewed farmers. These visits involved observing and recording the visual state of the farm, taking pictures and asking any questions that arose during the visit.

In El Valle and La Zahina the researchers had the help of Peace Corp volunteers and CREA field assistants, respectively, who were familiar with the area and trusted by the locals in the community. With the help of these volunteers research was readily accepted by the community, providing casual interviews in farmer's homes. Considering the sensitive nature of the financial data being collect, a strong relationship with the community was necessary to obtain the most honest and accurate data possible. Without

the help of these volunteers genuine answers collected on these field visits may have not been possible. Five full days were allotted for each trip into the field, with the intentions of interviewing and visiting the farms of four farmers in each town. In El Valle de Madroño a total of 7 interviews were done and the 4 most complete were chosen to be included in the project. In La Zahina another 7 interviews were conducted and the 5 most relevant were documented in the results section.

Upon returning from the field the collected data from each interviewed farmer was organized into tables. The tables were broken into three categories; social, environmental and financial (see *Tables 2-10*). Data fields are marked with “N/A” where a criteria was not collected, either because a farmer did not practice a technique or the data could not be analyzed.

Next, two farms from each town were chosen to conduct an economic analysis of culantro production from the collected data based largely upon chemical (fertilizer and pesticides), labor and transport inputs. Deciding which farms were chosen was based on which farmers provided the most complete and thorough data during interviews and how well this data complemented observations from the farm visit. This analysis provided estimates as to what the actual profit of growing culantro is at the end of a calendar year and what are the largest inputs for culantro cultivation. It also allowed insight into high vs. low input farms and other points of interest. Furthermore, three graphs were made from the data, two of which compare and contrast the monthly gains and expenses of culantro cultivation on a “high-input” and “low-input” farm in La Zahina. The remaining one is comprised of data collected from the governmental Instituto Mercadeo

Agropecuario of Panama demonstrating the fluctuating average annual price of culantro with the highest and lowest prices from 2003 to 2007.

### *3.2 Outline for Informal interviews*

*Box 1* of the appendix was used as an outline to guide questions and topics of discussion during the informal interviews with the farmers of El Valle and La Zahina. In each interview we tried to cover all of the six topics. Seeing as the nature of these interviews was informal, discussion sometimes strayed from the topic at hand. This format also gave the interviewers room to manipulate or add questions in the moment so as to cater to the situation of each individual farmer. This method worked very well and provided much information while keeping a relaxed and casual feel that is often lost in formal interviews.

### *3.3 Vendor Interviews in Panama City*

To supplement the financial data collected in the field we also spent time interviewing culantro vendors at three large produce markets in Panama City during the week of April 25<sup>th</sup>. The nature of these interviews was strictly economic, aimed at finding the high and low prices of culantro throughout the year, where the culantro is coming from and the profit gained by the vendors. This data is important in getting a broader sense of the financial implications of culantro. The data was organized into a graph (*Table 15*) and analyzed pertaining to seasonal fluctuations in prices, origin and any additional comments of interest.

## 4. RESULTS

### 4.1 Culantro: General Information Gathered from the Field

The following information was gathered from interviews and field observations in El Valle and La Zahina. Therefore none of the information has been supported through scientific experiments, nor does it necessarily hold true for culantro production in other regions. The presented information however, is all characteristics that were consistent throughout visits to both towns.

#### General Information and Points of Interest Regarding Culantro

- Culantro is the main source of income for the people living in both El Valle and La Zahina. More than 75% of the inhabitants of El Valle grow culantro.
- Most farmers grow culantro in parcels where seeds are broadcasted onto fields that have been prepared by slashing and burning previously existing forest and then growing maize on the land for one year to keep weeds from colonizing. There are minimal cases of culantro being grown in beds.
- Culantro is rarely grown on a parcel larger than half a hectare.
- Culantro is rotated every 1-4 years, in many cases between one other parcel, giving the land 2-3 years to rest between each crop.
- Each plant can be harvested once every 2 months. Harvest involves cutting the plant at its base, where it can regenerate over the course of two months.
- Some farmers grow culantro in partial shade, intercropping with yucca or plantain.
- Seeds are planted from the previous year. Seed selection for beneficial characteristics rarely occurs.
- Most growers sell between 2 and 4 sacos per week, depending on the farm size and amount of available labor.
- One “saco” consists of 5 “docenas” each of 12 “mazos,” which are approximately 1lb each. Each saco weighs between 50 and 70 lbs and is wrapped in plantain leaves to stay fresh.
- The price of a saco can fluctuate between 20 and 75\$ depending on the time of year.
- Some farmers have a contract with big markets (e.g. Super 99, Rey, Machetazo). These contracts offer a fixed price on each saco, in return for filling a quota of sacos (usually 2) per week.
- There are two varieties of culantro grown for commercial sale in the El Valle de Madroño region (*Table 1*).

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(Box 2: General information regarding culantro, gathered from the two field visits to El Valle and La Zahina)

## The Two Varieties of Culantro in El Valle de Madroño

<i>Variety</i>	<i>Coyote</i>	<i>Nacional</i>
<b>Size &amp; Shape</b>	Can grow over 30cm tall (and is therefore more valuable for market sale), with narrow leaves. Leaves are more supple than Nacional (wilt more easily)	Grows between 8 and 15 cm tall, with wider leaves than the Coyote variety. Tougher leaves (more durable for transport)
<b>Where it is Grown</b>	El Valle and La Zahina	La Zahina
<b>Flavor</b>	Mild, lacks strong odor	Stronger taste and odor, considered better by the inhabitants of La Zahina
<b>History</b>	Introduced from Costa Rica between 5 and 7 years ago, replacing Nacional in El Valle.	Perhaps natural to Panama. Has been around since culantro production has started in the area (i.e. 15-20 YBP)

(Table 1: Comparison between the two common varieties of culantro in the El Valle de Madroño region)

## 4.2 Interviews and Farm Visits

**EL VALLE DE MADRONO:**

<b>Farmer 1</b>		Interview and Farm Visit
Social	Personal History	Originally from Veraguas
	Land Size (Forest/Cultivated)	40 hectares (10 hectares cattle ranching with a small amount for cultivating crops, 30 hectares forest)
	Culantro Plot Size	¼ hectare
	Land Title	Under his name
	Other Crops Grown	Corn
	Time Growing Culantro	15 years
	Farm Visits per Week (just for culantro)	1-2
Environment	Pest Problems	Caterpillars
	Fungicide Application Rate	Does not use
	Herbicide Application Rate	6 x per year(1/2 gallon each application)
	Insecticide Application Rate	6 x per year(1/2 gallon each application)
	Fertilizer Application Rate	N/A
	Rotation	Changes plots every 2 years, will sometimes grow corn on the discarded plot
	Irrigation	Yes
	Land Preparation	Fumigates land to kill plants, then creates the beds, then plants

	Cultivation Style	Beds
	Deforestation Rate	N/A
	Comments about forest	Deforestation is bad and does damage to the land
Financial	Sells to	Pito (has a contract with Super 99)
	Number of Docenas Sold Per Week	10
	Amount Docena Sold For	\$5.00
	Transportation Costs	Does not pay because he sells as part of a contract
	Fungicide Costs	Does not use, says fungus does not occur
	Herbicide Costs	3 gallons per year at \$20.00 per gallon = \$60.00 per year
	Insecticide Costs	3 gallons per year at \$40.00 per gallon = \$120.00 per year
	Fertilizer Costs	N/A
	Day Laborer Costs	Hires 2 people every Wednesday at \$1.80 per docena

(Table 2: Interview Results from El Valle, Farmer 1)

General Comments:

- Culantro better to grow than corn because you can harvest it all year round, as opposed to just once or twice a year
- “Mucho trabajo, poco dinero”
- Refers to pesticides as ‘medicina’
- Irrigates all the time in the dry season, some areas flooded, while other areas were not effectively reached by the water

Farmer 2		Interview and Farm Visit
Social	Personal History	Originally from Las Margaritas, has been a farmer for 25 years
	Land Size (Forest/Cultivated)	15 hectares (14 forest, 1 under cultivation)
	Culantro Plot Size	½ hectare
	Land Title	N/A
	Other Crops Grown	N/A
	Time Growing Culantro	N/A
	Farm Visits per Week (just for culantro)	1-2
Environment	Pest Problems	Fungus
	Fungicide Application Rate	N/A
	Herbicide Application Rate	½ gallon 2 times a month
	Insecticide Application	¼ L applied per month

	Rate	
	Fertilizer Application Rate	Uses 12-24-12, application rate unclear
	Rotation	Uses plot for 2-3 years then switches, will sometimes grow sweet pepper along with culantro
	Irrigation	None
	Land Preparation	Cut down all plants on plot to clean, then apply fertilizer and plant
	Cultivation Style	Open field
	Deforestation Rate	Last logged 3 years ago
	Comments about forest	N/A
Financial	Sells to	Mercado central
	Number of Docenas Sold Per Week	10-20 (average of 15)
	Amount Docena Sold For	~\$6.00
	Transportation Costs	From El Valle to Las Margaritas for \$6.00, to Panama City \$4.25, \$0.50 to enter market, \$4.25 to return to El Valle
	Fungicide Costs	N/A
	Herbicide Costs	\$21.00/gallon x 12 per year = \$252.00
	Insecticide Costs	\$26.00/L x 3 per year = \$78.00
	Fertilizer Costs	N/A
	Day Laborer Costs	Hires day laborers 2-3 months of the year to harvest, pays \$1.80 per docena

(Table 3: Interview Results from El Valle, Farmer 2)

General Comments:

- Used to have a contract and now no longer does
- Upset that ANAM is strict about cutting down trees, says they cannot develop because of regulation, to avoid problems, he does not cut down trees
- Wants to switch to bed cultivation on a friend's land which already has corn growing on it , so most of the labor to construct the beds is already done

<b>Farmer 3</b>		Interview and Farm Visit
Social	Personal History	Was raised in El Valle (son of Farmer 1) and has had the farm for 15 years
	Land Size (Forest/Cultivated)	100 hectares
	Culantro Plot Size	½ hectare
	Land Title	Under his name, is still paying off the bank
	Other Crops Grown	None
	Time Growing Culantro	N/A
	Farm Visits per Week (just for culantro)	5
Environment	Pest Problems	N/A

	Fungicide Application Rate	Infrequent, used as needed
	Herbicide Application Rate	Infrequent, used as needed
	Insecticide Application Rate	Infrequent, used as needed
	Fertilizer Application Rate	N/A
	Rotation	None
	Irrigation	None
	Land Preparation	Slash and burn and broadcast seeds
	Cultivation Style	Open field with some other plants in
	Deforestation Rate	Deforested himself 1.5 hectares to cultivate culantro on, has not deforested any more
	Comments about forest	Trees are important to keep water and nutrients in the soil around the fields, block wind, create shade in dry season
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	10
	Amount Docena Sold For	\$4.00-\$8.00
	Transportation Costs	Brings to Panama City: \$5.00 to bring to Las Margaritas, \$3.25 to bring to city, \$0.50 to enter market, \$4.25 to return to El Valle
	Fungicide Costs	N/A
	Herbicide Costs	N/A
	Insecticide Costs	N/A
	Fertilizer Costs	N/A
	Day Laborer Costs	Does not hire labor

(Table 4: Interview Results from El Valle, Farmer 3)

General Comments:

- Leaves on Thursday to sell at market on Friday
- Bought old pasture land and has let trees re-grow on it for about 20 years
- Rice/Corn production: Gasto mucho, poco ganas

<b>Farmer 4</b>		Interview and Farm Visit
Social	Personal History	N/A
	Land Size (Forest/Cultivated)	Out of a 144 hectare farm he rents 1hectare to cultivate culantro
	Culantro Plot Size	1 hectare
	Land Title	Rents land
	Other Crops Grown	None
	Time Growing Culantro	N/A
	Farm Visits per Week (just for culantro)	5

Environment	Pest Problems	N/A
	Fungicide Application Rate	N/A
	Herbicide Application Rate	N/A
	Insecticide Application Rate	Applies after fertilizer to newly harvested patches
	Fertilizer Application Rate	Applies after harvest
	Rotation	None
	Irrigation	None
	Land Preparation	Slash and burn then clear away all dead weeds and brush, then plant seeds
	Cultivation Style	Open field with a few weeds mixed in
	Deforestation Rate	3 years ago they deforested the hectare on which they are now cultivating
	Comments about forest	N/A
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	15 per week, 5 docenas every 15 days as part of a contract
	Amount Docena Sold For	N/A
	Transportation Costs	None for contract culantro Goes to market twice a week: To bring to Panama City first time: \$5.00 to bring to Las Margaritas, \$3.25 to bring to Panama City, \$0.50 to enter market, \$4.25 to return to El Valle To bring to Panama City the second time: \$4.00 to bring to Las Margaritas, \$2.25 to bring to Panama City, \$0.50 to enter market, \$4.25 to return to El Valle
	Fungicide Costs	N/A
	Herbicide Costs	N/A
	Insecticide Costs	N/A
	Fertilizer Costs	N/A
Day Laborer Costs	Does not hire, works with 3 other people on the parcel, some his sons and 1 other man from El Valle	

(Table 5: Interview Results from El Valle, Farmer 4)

### LA ZAHINA:

<b>Farmer 5</b>		Interview and Farm Visit
Social	Personal History	Originally from Chiriquí, has been in La Zahina for 45 years
	Land Size	30 hectares

	(Forest/Cultivated)	
	Culantro Plot Size	¼ hectare
	Land Title	Under his name
	Other Crops Grown	Yucca, plantain, corn, sugarcane (subsistence) Also is a cattle rancher and raises pigs
	Time Growing Culantro	N/A
	Farm Visits per Week (just for culantro)	Infrequent
Environment	Pest Problems	N/A
	Fungicide Application Rate	Does not use
	Herbicide Application Rate	Does not use
	Insecticide Application Rate	Does not use
	Fertilizer Application Rate	Does use, application rate not known
	Rotation	N/A
	Irrigation	None
	Land Preparation	N/A
	Cultivation Style	Open field on flat land intercropped with banana trees and some wild plants
	Deforestation Rate	No longer deforests
	Comments about forest	Has heard of AD payments and wants to conserve his forest for this reason
Financial	Sells to	People in Las Margaritas
	Number of Docenas Sold Per Week	Only sells 1 mazo occasionally
	Amount Docena Sold For	N/A
	Transportation Costs	On horse or walking to get from La Zahina to El Valle, then \$3.00 to get from El Valle to Chepo/Las Margaritas
	Fungicide Costs	N/A
	Herbicide Costs	N/A
	Insecticide Costs	N/A
	Fertilizer Costs	1 quintal \$22.00 x 1 per year = \$22.00
	Day Laborer Costs	None

(Table 6: Interview Results from La Zahina, Farmer 5)

General Comments:

- The best cropping system for culantro is underneath plantain trees because they offer shade, but not complete shade
- Si no sembramos, que esperanza tenemos?
- Drip irrigation was not very accessible to farmers because the pipe for it is expensive, but it is less wasteful

- You can rent a car to go from La Zahina to Las Margaritas: the chiva driver will do it and it costs \$40.00 including gas
- Is interested in having organic fertilizer
- Refers to pesticides as venom
- Does not grow culantro commercially because of lack of day laborers and the high cost of transport

<b>Farmer 6</b>		Interview and Farm Visit
Social	Personal History	Originally from Veraguas
	Land Size (Forest/Cultivated)	100 hectares (49 forest, 51 under cultivation or cleared)
	Culantro Plot Size	½ hectare
	Land Title	N/A
	Other Crops Grown	Sweet pepper (for sale) Corn, rice (subsistence)
	Time Growing Culantro	N/A
	Farm Visits per Week (just for culantro)	2-5
Environment	Pest Problems	Caterpillars
	Fungicide Application Rate	Does use, application rate not known
	Herbicide Application Rate	Does use, application rate not known
	Insecticide Application Rate	In June when the caterpillar problem is bad, they may spray up to 3 times per week
	Fertilizer Application Rate	N/A
	Rotation	Keeps plot for 1 year, immediately after he grows either yucca or plantain
	Irrigation	None
	Land Preparation	N/A
	Cultivation Style	Open field, no other plants
	Deforestation Rate	N/A
	Comments about forest	N/A
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	25
	Amount Docena Sold For	\$2.00 - \$15.00
	Transportation Costs	On horse from La Zahina to El Valle, \$8.00 to go to Las Margaritas, \$6.25 to go to Panama City, \$0.50 to enter the market, \$4.25 to return to La Zahina
	Fungicide Costs	Arribo: \$6.00/L x 2 per year = \$12.00
	Herbicide Costs	Goal: \$30/L x 2 per year = \$60.00 Galan: Cost unknown x 2 per year

		Fusilada; \$10.00/L x 2 per year = \$20.00
	Insecticide Costs	N/A
	Fertilizer Costs	N/A
	Day Laborer Costs	Hires 5 day laborers to harvest per week at \$1.80/docena

(Table 7: Interview Results from La Zahina, Farmer 6)

General Comments:

- Will sometimes sell culantro in El Valle if the price is good
- Would grow rice if the price was better
- Refers to pesticides as ‘venemo’
- Culantro fields very clean, cut off seed tops are left on the soil to decompose and keep moisture in the soil
- Soil very rocky, but this does not bother him because it keeps the soil moisture in
- Does practice seed selection
- Wears gloves and boots when spraying pesticides and does read the information pamphlets on safety that come with the pesticides
- Culantro used to be profitable when the cost of chemicals was lower and the price per docena was higher, but now it sells for less and the inputs cost much more

<b>Farmer 7</b>		Interview
Social	Personal History	Originally from Chiriquí, has lived here 47 years
	Land Size (Forest/Cultivated)	98 hectares (44 hectares forest, 44 cultivated)
	Culantro Plot Size	½ hectare
	Land Title	Not his land, but trying to get it titled in his name
	Other Crops Grown	Beans, pigeon pea, rice (subsistence)
	Time Growing Culantro	9 years
	Farm Visits per Week (just for culantro)	1-2
Environment	Pest Problems	Boboboy (caterpillar)
	Fungicide Application Rate	Used as needed
	Herbicide Application Rate	Applies only 1 time per year to clear out the weeds before planting
	Insecticide Application Rate	Used as needed
	Fertilizer Application Rate	¼ quintal every 2 months
	Rotation	Has 2.5 hectares that he rotates culantro between, meaning that he has a 5 year rotation, immediately after culantro he grows pigeon pea

	Irrigation	None
	Land Preparation	Spray with herbicide to clear, then plants
	Cultivation Style	Open field (flat)
	Deforestation Rate	Doesn't want to cut down more trees (has done slash and burn in the past)
	Comments about forest	N/A
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	~3 (10 every 3 weeks)
	Amount Docena Sold For	\$2.00 - \$15.00
	Transportation Costs	Goes only 1 time every 3 weeks brings all the way to Panama City: \$5.00 to bring to Las Margaritas, \$3.25 to bring to city, \$0.50 to enter market, \$4.25 to return to El Valle
	Fungicide Costs	\$25.95/L x ~1 per year
	Herbicide Costs	N/A
	Insecticide Costs	\$27.95/L x 1 per year = \$26.95
	Fertilizer Costs	\$27.85 a quintal x 1 per year = \$27.85
	Day Laborer Costs	Does not hire, works with 2 sons

(Table 8: Interview Results from La Zahina, Farmer 7)

General Comments:

- Loses are not greatest from transportation limitations, but the fact that the market price is not fixed
- Contracts are the best way to produce culantro because the price is fixed
- Leaves the entire plot to mature to produce seeds, only actually sells culantro 9 months of the year
- If you grow culantro in a big plot, you will get a lot of problems with plagues therefore smaller plots are better
- Using too many chemicals also encourages plagues
- Identified fungicide as something that killed caterpillars

<b>Farmer 8</b>		Interview and Farm Interview
Social	Personal History	Originally from Veraguas, has lived here 32 years
	Land Size (Forest/Cultivated)	30 hectares (15 of forest, 15 under cultivation or cleared)
	Culantro Plot Size	½ hectare
	Land Title	Land not titled
	Other Crops Grown	Sweet pepper (also for sale) Yucca, plantain, rice, corn (all subsistence)
	Time Growing Culantro	10 years
	Farm Visits per Week (just for culantro)	2-3
Environment	Pest Problems	Caterpillars

	Fungicide Application Rate	Does not use
	Herbicide Application Rate	Does not use
	Insecticide Application Rate	Does not use
	Fertilizer Application Rate	1.5 quintals per year
	Rotation	Only wild weeds are in the culantro patch, when the land stops producing then yucca or plantain is planted immediately afterwards and left to grow there for two years, after these two years, the earth has recovered enough to grow culantro on it again
	Irrigation	No
	Land Preparation	Slash and burn
	Cultivation Style	Open field with weeds mixed in
	Deforestation Rate	¼ - ½ hectare per year (slash and burn)
	Comments about forest	N/A
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	10-15
	Amount Docena Sold For	\$3.00-\$12.00
	Transportation Costs	Transports to Panama City: on horse from La Zahina to El Valle, \$4.00 to bring to Las Margaritas, \$3.25 to bring to Panama, \$0.50 to enter market, \$4.25 to return to La Zahina
	Fungicide Costs	N/A
	Herbicide Costs	N/A
	Insecticide Costs	N/A
	Fertilizer Costs	\$14.00 a quintal x 1.5 quintal/year = \$21.00
	Day Laborer Costs	Does not hire, works with 3 other brothers

(Table 9: Interview Results from La Zahina, Farmer 8)

General Comments:

- Wants to get title in the future
- Has no interest in buying more land
- Doesn't use chemicals because of the high cost and the fact that they are damaging towards the environment
- Grows better in shade
- Uses the decomposing seed tops to line the bags sold at market to cushion the effects of the rough transportation
- Leaves a patch in his culantro field for 3 months for the seeds to mature, no seed selection
- Would like to grow chives or parsley, but the transportation is too difficult

<b>Farmer 9</b>		Interview
Social	Personal History	Originally from Veraguas, has lived here 42 years
	Land Size (Forest/Cultivated)	15 hectares (7.5 forest, 7.5 cultivated or cleared)
	Culantro Plot Size	¼ hectare
	Land Title	N/A
	Other Crops Grown	N/A
	Time Growing Culantro	15 years
	Farm Visits per Week (just for culantro)	2
Environment	Pest Problems	N/A
	Fungicide Application Rate	1 time every 3 months
	Herbicide Application Rate	Roundup 1 time a year Goal and Galagan 1 time every 6 months
	Insecticide Application Rate	1 time every 3 months
	Fertilizer Application Rate	2 quintals a month
	Rotation	Changes culantro plot every year
	Irrigation	None
	Land Preparation	Slash and burn, then sprays with Roundup, then broadcasts the seeds
	Cultivation Style	Open field with some other weeds and plants mixed in
	Deforestation Rate	¼ hectare every year
	Comments about forest	N/A
Financial	Sells to	Mercado Central
	Number of Docenas Sold Per Week	10
	Amount Docena Sold For	\$3.00 - \$15.00
	Transportation Costs	Goes to market once a week: on horse from La Zahina to El Valle, \$5.00 to go to Las Margaritas, \$3.25 to go to Panama City, \$3.00 in cab fare to get to the market, \$0.50 to enter the market, \$4.25 to return to La Zahina
	Fungicide Costs	Arribo: \$6.00/L x 4 per year = \$24.00
	Herbicide Costs	Roundup: \$6.50/L x 1 per year = \$6.50 Fusilade: \$10.00/L x 2 per year = \$20.00 Goal: \$30/L x 2 per year = \$60.00
	Insecticide Costs	Hormitoc: \$6.00/lb x 4 per year = \$24.00
	Fertilizer Costs	1 quintal: \$30.00 x 24 per year = \$720.00
	Day Laborer Costs	Hires 8 day laborers every 2 weeks; 4 to clean

		the fields at \$6.00 per day and 4 to harvest at \$1.80/docena (14 docenas need to be harvested)
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*(Table 10: Interview Results from La Zahina, Farmer 9)*

General Comments:

- Contract seen as very positive
- Plans all harvests around the river
- Papaya and chives are better value, but the cost of seeds is too high
- Culantro not a bad crop to grow because it can grow anywhere, whereas crops such as carrots require beds and irrigation
- Leaves a patch in his culantro field for 3 months for the seeds to mature, no seed selection
- The cost of fertilizer and chemicals has increased significantly
- If you cut down primary forest the soil can be used for up to 10 years without fertilizer, which is a strong incentive for farmers to slash and burn
- Estimates that after all his expenses, he only makes about \$15.00 per week growing culantro
- “Dinero seguro”

## 4.3 Annual Financial Summaries

<i>Farmer 1 – El Valle</i>			
<b>Expenses</b>	<b>Cost(\$US)/Unit</b>	<b>Unit/Year</b>	<b>Cost/Year(\$US)</b>
<b>Herbicide</b>	20/gallon	3 gallons	-60.00
<b>Insecticide</b>	40/gallon	3 gallon	-120.00
<b>Labor</b>	1.8/docena	347 docenas	-624.60
<b>Sale</b>	5/docena	520 docenas	+2600.00
<b>Total</b>			<b>+1795.40</b>

(Table 11: Annual Financial Analysis, Farmer 1)

<i>Farmer 2 – El Valle</i>			
<b>Expenses</b>	<b>Cost(\$US)/Unit</b>	<b>Unit/Year</b>	<b>Cost/Year(\$US)</b>
<b>Herbicide</b>	21/gallon	12 gallons	-252.00
<b>Insecticide</b>	26/L	3L	-78.00
<b>Labor</b>	1.8/docena	150 docenas	-270.00
<b>Transport</b>	16/trip	52 trips	-832.00
<b>Sale</b>	6/docena	780 docenas	+4680.00
<b>Total</b>			<b>+3248.00</b>

(Table 12: Annual Financial Analysis, Farmer 2)

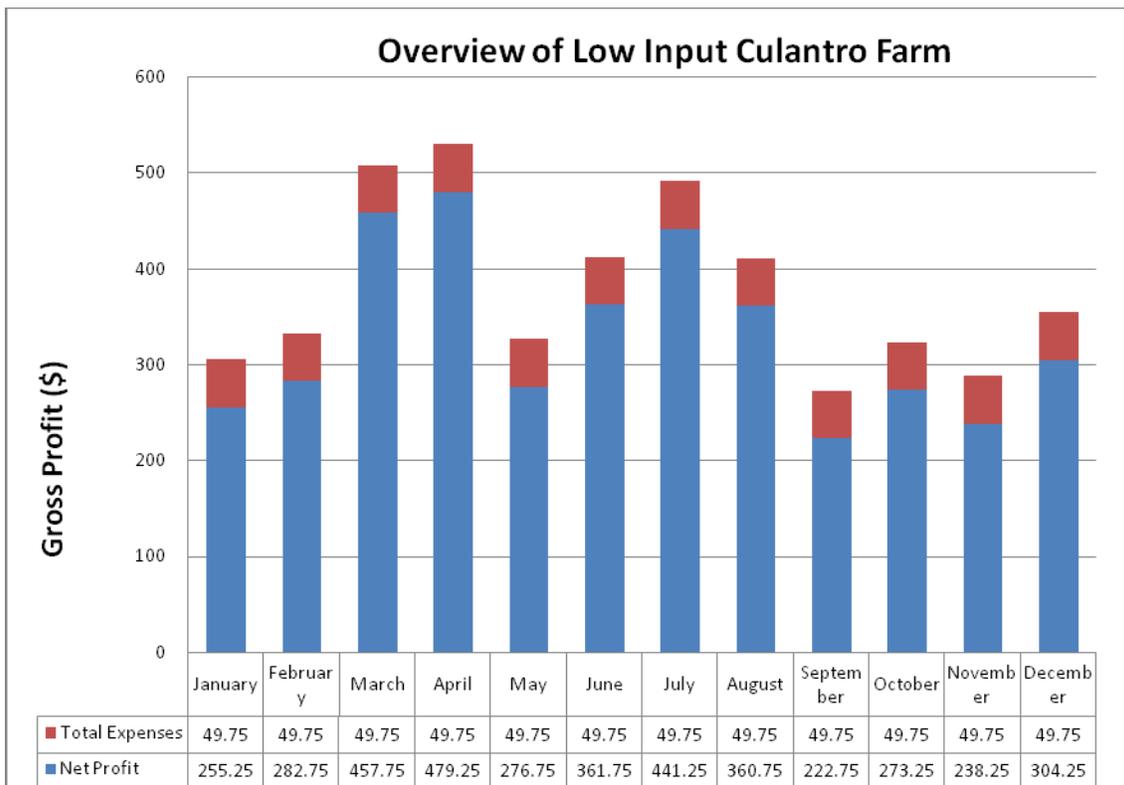
<i>Farmer 8 – La Zahina (Low-Input)</i>			
<b>Expense</b>	<b>Cost(\$US)/Unit</b>	<b>Unit/Year</b>	<b>Cost/Year(\$US)</b>
<b>Fertilizer</b>	14/quintal	1.5 quintales	-21.00
<b>Transport</b>	12/trip	48 trips	-576.00
<b>Sale</b>	7.50/docena	600 docenas	+4500.00
<b>Total</b>			<b>+3903.00</b>

(Table 13: Annual Financial Analysis, Farmer 8)

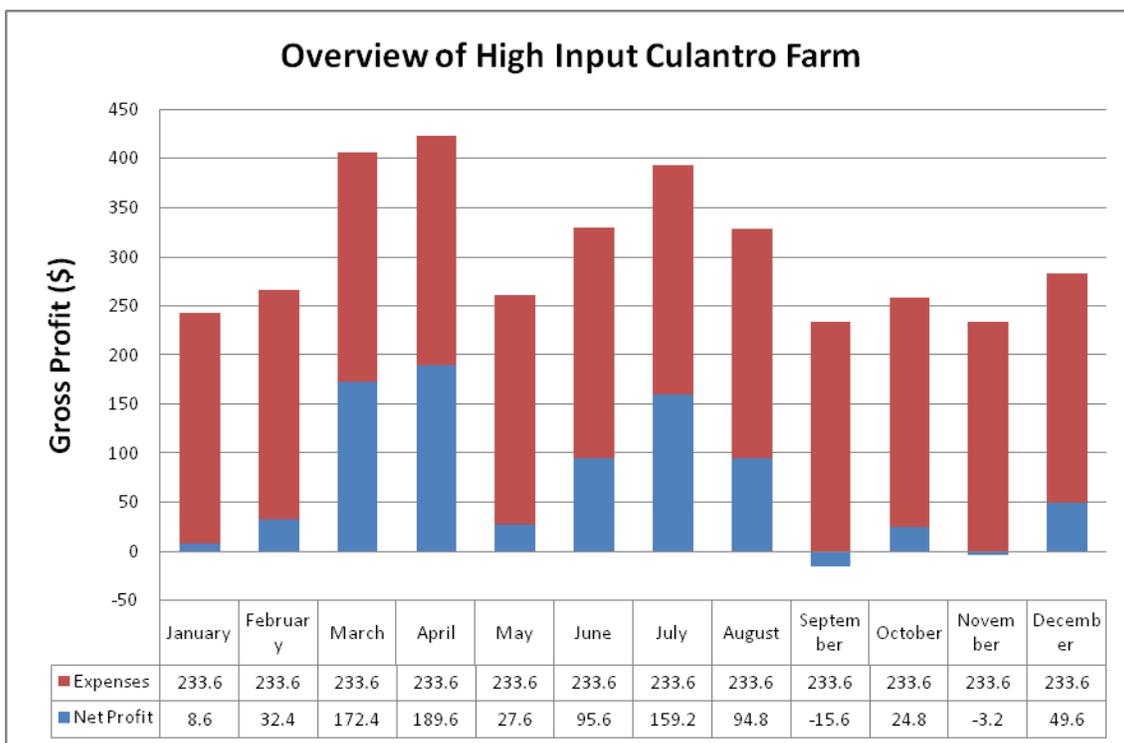
<i>Farmer 9 - La Zahina (High-Input)</i>			
<b>Expense</b>	<b>Cost(\$US)/Unit</b>	<b>Unit/Year</b>	<b>Cost/Year(\$US)</b>
<b>Fertilizer</b>	30/ quintal	24 quintales	-720.00
<b>Labor (Cleaning)</b>	24/4 workers/day	24 days	-576.00
<b>Labor (Cutting)</b>	1.80/ docena	336 docenas	-604.80
<b>Roundup (Herbicide)</b>	6.50/L	1L	-6.50
<b>Fusilade (Herbicide)</b>	10/L	2L	-20.00
<b>Goal (Herbicide)</b>	30/L	2L	-60.00
<b>Arribo (Fungicide)</b>	6/L	4L	-24.00
<b>Hormiloc (Insecticide)</b>	6/lb	4lbs	-24.00
<b>Transport</b>	16/trip	48trips	-768.00
<b>Sale</b>	8/docena	480 docenas	+3840.00
<b>Total</b>			<b>+1036.70</b>

(Table 14: Annual Financial Analysis, Farmer 9)

4.4 Monthly Financial Summaries Graphing High and Low-Input Culantro Cultivation



(Chart 1: Monthly Expenses and Net Profit of Farmer 8, La Zahina)



(Chart 2: Monthly Expenses and Net Profit of Farmer 9, La Zahina)

Note: Gross profit values determined by using monthly averages reported by the Instituto de Mercadeo Agropecuario Direccion Informacion Comercia for 2007. Expenses determined per year and divided by 12 for the total number of months in a year. High input referring to the farms owned by Farmer 8 and Farmer 9 and assuming that 4 weeks out of the year they is unable to sell culantro.

#### 4.5 Vendor Interview Results

The following is information on the origins and the prices of culantro in Panama City, gathered in the week of February 25<sup>th</sup> 2008.

#### Information from Vendors in Panama City

Vendor	Price Bought (\$US/Unit)	Price Sold (\$US/Unit)	Origin	Comments
1	0.5/lb	1.00/lb	Coclé Province	Price can double from April to December, where he buys for \$1.00/lb and sells for \$2.00/lb
2	0.5/lb	0.75/lb	Coclé Province	Price doubles in wet season, buy at \$1.00 and sell at \$2.00
3	0.5/lb	0.75-1.0/lb (depending on quantity bought)	Chepo and El Valle	N/A
4	1.0/lb	1.25/lb	Chepo and San Carlos	Dry Season: buy at \$1.25 and sell at \$1.75
5	0.5/lb	0.75/lb	Darién, Chepo and El Valle	N/A
6	0.75/lb	1.00/lb	El Valle	N/A
7	0.5-0.75/lb	1.00-2.00/lb	El Valle	Culantro becomes cheaper with rainy season
8	1.0/ Mazo	1.50/Mazo	Moncampo	Nov. Oct. and Sept. are the cheapest months
9	0.95/ Mazo	1.25/Mazo	Chepo	N/A
10	1.0 / Mazo	1.5/Mazo	“Interior Mountains”	Cheap in Winter and expensive in summer
11	1.5/ Mazo	3.00/Mazo	“Don’t know”	N/A
12	1.0 / Mazo	1.50/Mazo	“Don’t know”	N/A
13	1.0 – 2.0/ Mazo	\$0.10 or more for small bunches	Chepo	N/A

(Table 15: Market prices and origins of culantro according to vendors in Panama City)

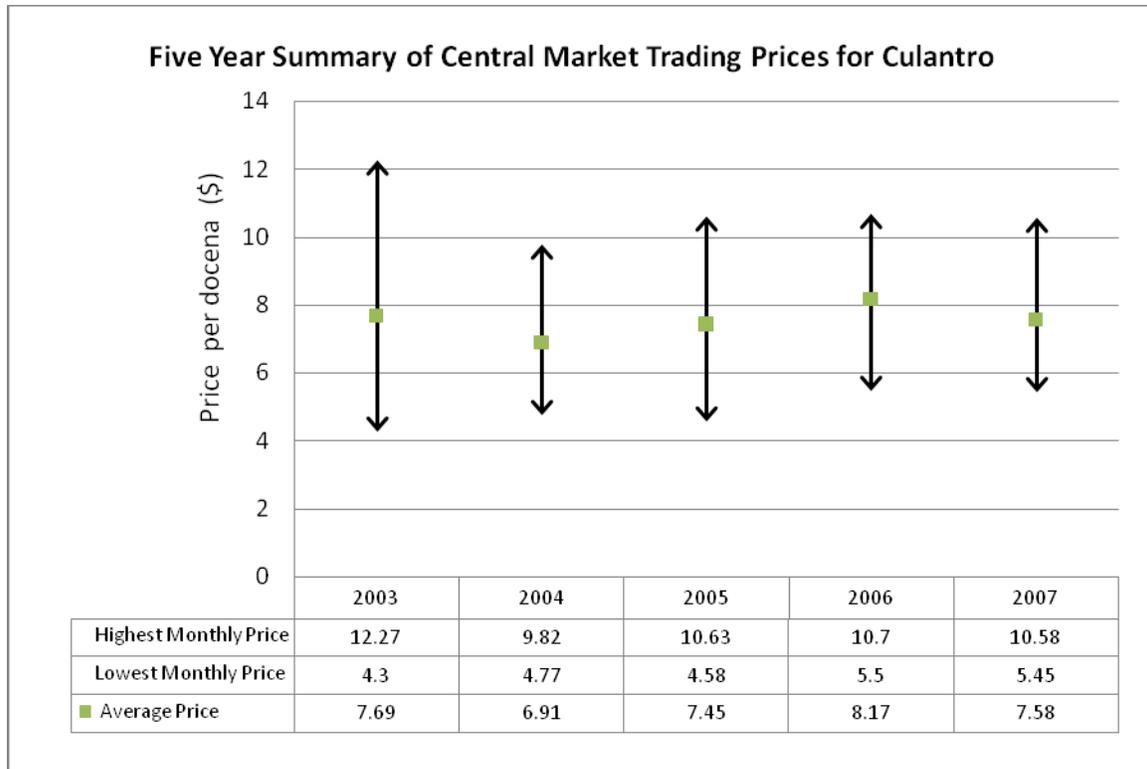
Vendors 1-7 in the above table were interviewed in the large open air produce market west of Caledonia in Panama City. Vendors 8-10 were interviewed in the large produce market south of the fish market on the border of Caledonia and Santa Ana, and the last three were interviewed in the street market along Av. Central in Caledonia. The market west of Caledonia, on the border of Caledonia and Curundu is one of the largest in the city and may account for the different units encountered at this market in comparison to the two smaller markets. The overwhelming difference, between this market and the other two were the statements that culantro is cheaper in the dry season than it is in the wet season. The vendors at the two smaller markets claimed that culantro was more expensive now (during the dry season) than it is during the wet season.

#### Market Prices of Culantro

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
2006	7.61	8.9	9.48	10.03	8.98	9.94	10.7	8.47	6.26	6.46	5.5	5.74	8.17
2007	6.1	6.65	10.15	10.58	6.53	8.23	9.82	8.21	5.45	6.46	5.76	7.08	7.58

(Table 16: Market prices of culantro according to Instituto de Mercadeo Agropecuario Direccion Informacion Comercial, 2006 & 2007. All prices are for a quantity of 12 Mazos ("Docena") of culantro and listed in USD)

Culantro does fluctuate in price throughout the year and according to the Instituto de Mercadeo Agropecuario's 2007 and 2006 data (Table 16), culantro prices are highest in March and April (the end of the dry season) though prices also reach a peak in July and August. Prices are lowest during the months of September and October.



*(Graph 3: Fluctuating Market Prices of Culantro as Recorded by the Instituto Mercadeo Agropecuario from 2003-2007)*

## 5. DISCUSSION

The results from this research have shed light on many of the aspects of culantro cultivation in the El Valle de Madroño region of Panama Province, Panama. Culantro has its perceived and real benefits to farmers and the community alike, though many down-falls of the crop are unknown or overlooked by farmers. Problems such as high reliance on hired labor, chemical fertilizers and pesticides, misdiagnosis of plagues, transportation insecurity, seasonal fluctuations in price and the increasing price of oil all threaten the future security of culantro production in this area. From the results of this field work and discussion of the aforementioned issues surrounding culantro production recommendations will be made for the future sustainability of this crop, keeping in mind

the differences between the two towns of interest, the social well-being of the inhabitants of the valley and the health of the surrounding rainforest.

The greatest problems encountered in the research were gaps in information pertaining to the questions listed in *Box 1*. None of the interviewed farmers keep any records of money spent on farm inputs or profits from outputs, therefore many did not know the answers to presented questions. Furthermore, hardly any farm aspect with a quantitative characteristic was precise. Many answers would involve a range, whether it be for field size, fertilizer application, years growing culantro or anything involving a monetary price.

### *5.1 Comparisons Between El Valle and La Zahina*

El Valle is located approximately 15km from the Pan-American highway, connected by a dirt, mountain-pass road. There is a chiva that provides service once a day, commuting between El Valle and Chepo. Culantro is loaded onto the chiva by the saco and transported out of El Valle on an almost daily basis.

This easily accessible transportation is strong support for the inhabitants of El Valle to grow culantro and incentive to rely on its sale for food-money. Most growers in El Valle tend their fields 2-3 times a week and hardly grow any crops beside culantro. The money earned through the sale of culantro is consistent and generous enough for these farmers to buy all the grains and meat they need. Buying this food-stuff is also highly dependent on the chiva and its service as a connection to the more developed towns lining the highway.

La Zahina is located approximately 5km further from the Pan-American highway than El Valle. The road between La Zahina and El Valle is very rugged and seasonal,

requiring the crossing of many rivers and climbing of steep mud banks (*Picture 3*). For this reason there is no chiva service to La Zahina, making transportation of goods and food much more difficult for its inhabitants. Transport of culantro and other resources in and out of the town requires a 1 and ½ hour trek on horseback into El Valle. During the wet season there can be days at a time where the road is not serviceable, lined by rivers too dangerous to cross. Fortunately for culantro farmers the wettest months of the year tend to coincide with the lowest market price of culantro throughout the year and therefore there is little economic loss during the weeks where transport is impossible.

Because of transport constraints the people of La Zahina rely less on the commercial sale of culantro and farm a larger variety of crops for subsistence. Because the people of La Zahina farm a greater variety of crops they spend much more time on their farms, working up to 6 days per week in the field. Families often share a piece of land and the men will all work on the same parcel, sharing harvests and profits from sale of culantro and sweet peppers. There is also a higher occurrence of small-scale cattle ranching, seeing as the transport of cattle for sale is rarely urgent, whereas culantro must be transported shortly after it is harvested so as to keep fresh.

There are three main ways of cultivating culantro that were observed in the two towns. The first is open field where a portion of land is cleared, often through slash and burn, and the seeds are broadcast and left to grow (*Picture 4*). Cleaning and weeding of the field can be done as needed. The second type of production is in beds (*Picture 5*). There was only one example of this seen and it involved irrigation, but it is unknown at this time if irrigation in bed cultivation is common. This involves making raised beds and

cleaning as well as weeding as necessary. The final method of production is intercropped with other plants and grasses to provide some shade.

Farmers in El Valle rarely grow culantro in shaded areas or using an intercropping system (*Picture 4*). Though some farmers know of these techniques they prefer to grow in open fields and strictly grow the Coyote variety. Coyote grows larger than Nacional and is therefore easier to cut more weight in a shorter period of time. Coyote's downfall as a poorly transported variety is not of much concern to the growers of El Valle since chiva access is so convenient and cuts down field-to-market time considerably from that of growers in La Zahina or other less accessible towns.

Possibly related to growing the single variety in open sun is the frequent occurrence of disease in El Valle crops. Farmers are highly dependent upon pesticide use and would often refer to it as 'medicine'. They are particularly plagued by a 'fungus' that turns the leaves yellow and requires generous applications of fungicide to treat according to the farmers. The yellow leaves and burned-looking characteristics of this fungus may be side-effects of growing in direct sunlight and may not be a fungus at all.

Contrarily, the some growers of La Zahina primarily grow culantro in the shade of yuca or plantain and rely less on pesticides, although they are still used extensively. Though this is partially a function of lower access to nearby cities, the farmers of La Zahina are more aware of the negative effects of pesticide use, referring to it as 'poison' and believing that heavy use leads to more pests. These growers had almost no 'fungus' problems and rely very infrequently on the use of fungicide. Despite the high amount of pesticides used, in some cases there were serious gaps in knowledge about their effects. For example, one farmer spoke about using fungicides to treat caterpillar problems.

Seed selection was only practiced by one out of the nine farmers interviewed and he lived in La Zahina. All farmers do leave a portion of their fields to mature into seeds since the price of culantro seeds is high (approx. \$100.00 for a gallon)

### *5.2 The Forest*

Culantro production takes up very little land in comparison to cereal crops and pasture in other areas of Panama. None of the farms visited in this research had more than 1 hectare of land devoted to culantro, the majority devoting between 1/8<sup>th</sup> and 1/2 of a hectare. Of these farms only one out of nine practices bed cultivation (Farmer 1, *Picture 5*), while the others prepare land for culantro by slashing and burning an area of forest and then broadcasting the seeds on the freshly burned earth. This may or may not be preceded by heavy chemical fertilizer and pesticide application to the field.

CREA's goal is to disseminate knowledge about responsible land management that could extend the fertile period of a parcel of land, thereby reducing destruction of primary and secondary rainforest in the valley. Throughout the interviews it became apparent that most farmers in the area are aware of many of these management techniques, yet they either felt that they lacked the initial capital or resources to apply them or they were won-over by the ease in which they can continue to practice traditional management techniques. Many farmers expressed that they would like to do bed cultivation to cut back on space required for the culantro, but they lacked the money and time to build the beds and can not afford to risk losing a harvest. "Bed cultivation is more intensive than growing on parcels but it requires much less space" (Farmer 5). This appeals to farmers because it makes cleaning and harvesting easier, as well as requires less fertilizer and pesticides which are also easier to apply to a bed. Furthermore one

farmer brought up the fact that when growing in beds it becomes easier to grow closer to home. Most of the visited farms were at least a ½ hour walk from the farmer's house, often through rivers and dense jungle. Being able to cultivate closer to home makes transport much easier with less reliance on animal labor (namely horses for transporting sacos from field to chiva).

There were also a couple farmers (Farmer 5 and Farmer 8) who had heard of and expressed interest in a potential avoided deforestation credit program in the future. Such a program would work to offer a sum of money per unit land left as forest. The program would be implemented by either the government or private institutions and offer slightly more than the agricultural value of a piece of land to keep the land as forest. Farmer 5 said he was not cutting any more forest because he wanted to be eligible for such a program if it is implemented.

The financial component of this research could be used as a resource in determining the sum of money that would appropriately offset culantro production in lieu of avoided deforestation. It is important to take into account that the annual values calculated through this research vary greatly and are based on a large range of land sizes dedicated to culantro (1/8 – 1 ha).

While these land sizes can greatly vary, there seems to be a threshold at which farmers cannot cut more than a certain amount of sacos per week regardless of farm size. The farmers are restricted by time and labor and therefore rarely sell more than 4 sacos (20 docenas) per week. This labor restriction should be taken into account for the application of any future avoided deforestation program and can also be used as support for convincing farmers they can get the same yields using less land.

From field observation it was apparent that many farmers had more land dedicated to culantro than they could possibly harvest. This was likely for extra security in case an area was attacked by plagues and because farmers are under the false impression that the larger the field the more money they can make. Time and labor restrictions are stronger regulators as to how much culantro can be harvested than is field size. If these farmers could be convinced that they can harvest the same amount of culantro on a smaller field, it would result in much more land left as forest.

### *5.3 Motivation*

Culantro was described by several of the farmers interviewed as being a large amount of work for little money. However, many of them continue to grow the crop and are not considering pursuing an alternative. Although the initial position of farmers towards culantro seemed negative, during interviews many of the positive aspects of culantro were discussed to better understand farmer motivations for growing this crop.

One of the main obstacles impeding the growth of other cash crops in both La Zahina and El Valle is transport. Three out of the nine farmers cited this as the primary dissuasion from diversifying. Interest in crops such as parsley and chives was mentioned, but concerns about them being damaged during transport, the high cost of transport or the road not being passable were strong. While culantro needs to be brought to market as soon as possible as well, it is less likely to get damaged or wilt in transport if it is packed properly with adequate moisture.

Not only is transport a concern when growing alternative crops such as parsley or chives, but the cost of seeds and the high cost of transition also pose a problem. Culantro is easily left to seed and farmers can save their seeds from year to year. Those

interviewed did not think that this would be a possibility with either of the other crops. A large amount of money and labor would need to be invested initially when making the transition, two inputs that many farmers are not capable of affording or not willing to invest. According to some farmers, MIDA was not willing to fund smaller projects so there were no opportunities for financial assistance to make the transition easier.

The condition of soil was also a strong motivating factor to grow culantro. Whereas other crops such as carrots would require beds and irrigation culantro will grow in almost any soil, under a variety of conditions and does not require irrigation. The farmers interviewed were looking to minimize the time they spent in the field while maximizing the amount of profit they could generate. Although culantro is seen as being very labor intensive, a farmer may only need to go into the field twice a week to clean and harvest his crop. Alternative crops mentioned such as carrots, chives and parsley would require more labor compared to culantro. In the case of La Zahina, where most families grow a variety of other crops for subsistence, labor is a major constraint.

Input costs are also a concern with the rising cost of fuel. Alternative crops require the same amount of inputs and the market prices are not fixed, meaning that similar to culantro production, once all other costs are accounted for the farmer may only be making a small amount of money. That being said, in 2007 the average price for a docena of parsley was \$13.20, and the average price of a docena of chives \$13.74 compared to \$7.58 a docena for culantro (Instituto Mercadeo Agropecuario, 2007). There are many pest concerns in the area as well and many farmers were concerned about crop failure. At this time it is unclear whether the alternative crops mentioned are more

susceptible to pest attacks than culantro since Farmer 2 from El Valle estimated that he loses 25% of his crop annually to pests.

Although culantro is still considered by farmers to be “Mucho trabajo por poco dinero” and “Mucho gasto por poco rendimiento” it does provide a reliable income throughout the year and is easily grown on farms regardless of the slope and soil type. As with all agricultural producers, money is the most important factor and many farmers are only willing to switch to growing other crops, such as rice, if the price is right. Most alternative crops are more labor intensive than culantro and require the same amount of inputs while more likely to be damaged in transport or spoil before they get to market. Despite the many complaints voiced about culantro, farmers do not believe that there are better alternatives available.

#### *5.4 Contracts and Price Fluctuations*

One of the biggest problems consistently expressed by farmers interviewed in both La Zahina and El Valle de Madroño were the price fluctuations throughout the year. As seen in *Table 16* the recorded price at which culantro was trading at in central markets around Panama City varied in 2007 between \$5.45 and \$10.58 per docena. Since there are 5 docenas in every saco that is a price difference of \$25.65 for every bag sold. These fluctuations have prompted some culantro farmers to opt for contracts.

Many of the larger supermarket chains throughout Panama require a steady stream of culantro and will give out contracts either to farmers directly or intermediates. Out of the 9 farmers interviewed only two sold any of their culantro to contractors; Farmer 1 and 4, both of whom had farms in El Valle de Madroño. While Farmer 1 only harvested culantro for contract purposes, Farmer 4 harvested 11 bags every 2 weeks with

only 1 destined for contract. In both cases, the contract was given to someone without a farm, who then sub contracts out to several people. Presumably this is because the contract is too large for any one farmer to fulfill by himself.

The largest farm visited was a hectare, and most were between 0.5 and 0.25 hectares. For smaller farms, even providing 2 sacos a week could be difficult. In the case of Farmer 1 when his culantro fields did not provide enough to fulfill his contract he would supplement from Farmer 3's fields. In the past Farmer 2 had a contract but was unable to fulfill it at times and eventually it was not renewed.

In El Valle de Madroño the attitude towards contracts was mixed with some farmers feeling it was a good idea and others not interested in having one. However, the attitude was different in La Zahina. Two out of the 5 farmers (Farmers 7 and 9) interviewed explicitly stated that contracts were superior to selling it at the market because of the fixed price. To the researchers' knowledge, no farmer in La Zahina has a contract. This is most likely due to the transportation issues. Contracts value consistency and punctuality. Due to the many rivers that need to be crossed sometimes harvest must be delayed days to wait for a time when the water levels are low enough. This would make farmers in La Zahina unlikely candidates because they have unreliable access to transport.

The problems created through price fluctuations were often brought up by farmers in La Zahina. In fact, although transport is a huge issue, Farmer 7 stated that the biggest losses of income are not from the missed harvests due to the river, but from the lack of fixed prices. Culantro prices drop during the wet season because the crop requires a lot of water and at this time many more people are able to grow it successfully. The wet season

is also the time when farmers have the most difficulty to transport culantro out of either La Zahina or El Valle de Madroño. At times a farmer will pay money for laborers to harvest the culantro and transport it to market only to find out the price is just barely enough to cover his costs and may actually be losing money.

The Instituto de Mercadeo Agropecuario reported in 2007 that the lowest price paid per docena of culantro was \$5.45. All of the 9 farmers interviewed stated that the price of culantro falls below this. Some even mentioned that in the wet season the price will drop as low as \$1 to \$2 dollars per docena. Considering that most farmers will pay \$1.80 per docena just to have it harvested these prices are not sufficient to cover the cost of transport or chemical inputs such as fertilizer and pesticides. The majority of farmers interviewed stated that they would not sell their culantro for less than \$4.00 a docena. At this time it is unclear what the difference is between what farmers actually receive for their culantro and the selling price recorded by the Instituto de Mercadeo Agropecuario. Many farmers also reported that they could be paid as much as \$15 for a docena meaning that the fluctuations reported by farmers are greater than those observed by the government.

This has complicated the financial analysis portion of our study because the average annual prices quoted by farmers does not match that recorded by the government. In *Tables 11-14* the annual estimate of income is based off the average amount farmers believe they get over the course of the year per docena. In the case of Farmer 9, his estimate was \$0.42 lower than the average recorded by the government. In *Graph 1* and *Graph 2* the monthly summary done is assuming that farmers are being paid the government recorded average for the corresponding month in 2007. Farmer 8's estimate

of \$7.50/docena as a yearly average is only \$0.08 off of that recorded by the government. Consequently, *Graph 1* depicts his yearly income as \$3954.00, while *Table 13* states his yearly income as \$3903.00, a difference of \$51.00. However, *Graph 2* depicts Farmer 9's yearly income as \$835.80, while *Table 14* states his income is \$1036.70, a difference of \$200.90. At this time, the researchers believe that the farmer's estimates for the average price of their culantro over the year is more accurate than the government's because the government numbers represent an average of a variety of amounts paid for culantro, not the specific case of this area.

The purpose of *Graph 1* and *Graph 2* is to show the huge difference that inputs make in the profit earned by a farmer. Two months out of the year Farmer 9 is losing money by not covering his costs. The price fluctuations seen throughout the year show that a farmer's income earning \$189.60 in a month or suffering a loss of \$15.60 over the course of a month.

According to farmers in La Zahina when they began growing culantro they considered it a profitable crop, but now it has become much more expensive and difficult to grow. The sentiment among farmers is that the prices used to be much higher and the input prices lower. The Instituto de Mercadeo Agropecuario only has culantro prices recorded from 2003 so any market prices prior to that are unknown. The fluctuations over the past five years are shown in *Graph 3*. There has been a difference of \$1.26 in the averages in the past five years with the average price peaking in 2006 at \$8.17 per docena. Although the price of culantro has remained fairly constant the price of inputs has risen sharply. Many of the farmers interviewed are heavily dependant on fertilizer

and pesticides and have been severely affected by the price increases due to the rising price of oil.

These increases in the price of inputs, but not in the price paid to farmers, leaves farmers feeling unsure about the profitability of the crop. The price of oil is continually rising and shows no signs of leveling off. Some of the farmers interviewed have expressed interest in using organic compost to lower their costs, however, this compost is less potent than chemical mixes and must be coupled with other management practices such as soil conservation to be very effective. It is unclear whether farmers will be willing to make these changes to save on costs.

### *5.5 Transport*

In every farm visited, with the exception of Farmer 1, who had a contract, with set prices per saco, transport was the highest input to the cultivation and sale of culantro. On average the other 7 farmers (not including Farmer 5, who does not sell culantro on a regular basis) spend \$14.75 per week on transporting culantro. This is more expensive than all other inputs individually and all chemical inputs combined.

The main vehicle for transport out of El Valle is the chiva (*Picture 6*) that goes from Chepo to El Valle de Madroño and back, passing through Las Margaritas, once a day. The chiva leaves Chepo at 9:00am every morning and arrives in El Valle between 10:00 and noon depending on road conditions. The chiva is an old 4x4 truck with benches in the back and a roof-rack for bringing goods. The driver charges \$3 per person to ride one way, plus an additional \$1 for every saco of culantro.

The car is in poor condition and consequentially uses vast amounts of gas for the short trip especially when carrying a full-load. Not only is the functional capability of the

chiva constantly in jeopardy but with the rise in gas prices there is the possibility of an increase in chiva fares, raising net transport costs even higher for farmers. This increase in price could be devastating for the farmers of El Valle if it is not coupled with an overall increase in culantro prices.

Currently there is work being done on the road between El Valle and Chepo. The steep, rugged road, a major obstacle for transportation, will apparently be paved within the next 2 to 3 years. This upgrade will greatly improve transport in and out of El Valle and make possible the addition of another chiva or maybe even a small bus or shuttle.

Currently there is also the possibility for the inhabitants of the El Valle region to rent a truck to get in and out of Chepo. The truck can be rented from the chiva driver and costs \$40 for the day to go from El Valle to Las Margaritas. This option is less favorable due to the high price but farmers will sometimes share the cost if a trip is really necessary.

## **6. RECOMMENDATIONS AND CONCLUSIONS**

From the information gathered through the fieldwork conducted in this research along with the information from the literature review some recommendations can be made about the environmental, social and financial aspects surrounding the cultivation of culantro. These recommendations depend greatly upon what is hoped to be done with the information gathered in this research. Humanitarian recommendations such as improving the efficiency of culantro cultivation and bringing more income to the farmers will be quite different from recommendations of how to decrease deforestation and improve the quality of the surrounding environment. These recommendations aim to protect the

forest as well as the quality of the surrounding environment without sacrificing, and ultimately optimizing, the quality of life for the farmers of the area.

### *6.1 Environment*

By far the most important recommendation in this category is more information in the area about sustainable agricultural practices, the importance of the forest and responsible land management techniques. CREA has done a great job in the area, especially in La Zahina, teaching farmers sustainable practices they can use to save money for themselves while protecting the surrounding environment. Earth Train is another organization in the area that is also interested in preserving the surrounding forest, but place little emphasis on the social well-being of the surrounding community. In small rural communities it is very important to see the human inhabitants as part of the ecosystem and therefore an integral part of any management that is sought to be done in the area.

Special educational emphasis should be put on reducing chemical use in the area. Heavy applications of pesticides and chemical fertilizers are very common for culantro cultivation but are not necessarily needed. Sometimes these applications are just wasting farmer's hard-earned money while adding dangerous chemicals to the environment. These chemicals are dangerous for the humans working with them as well as the local wildlife and plant life, affecting water, soil and therefore forest quality.

Furthermore, only one of the interviewed farmers said they practiced seed selection when planting a new parcel. Seed selection is a great way to reduce farm inputs by naturally increasing crop quality. Farmers would not have to spend any money by selectively taking seeds from plants that seemed to be more healthy, pest resistant, larger,

etc. With a genetically healthier crop there would be less reliance on chemical inputs, putting less strain on farmer's pockets and the environment.

### *6.2 Society*

Farmers in the area have nearly all come from the interior, many from Veraguas and Chiriquí, within the last 40 years. These same farmers have only been growing culantro for, at most, the past 15 years. Any future research should keep this in mind and try to understand that these people are not deeply rooted with the area. In many cases we had farmers tell us they were "Chiricano" (for example) when they had been born in the studied region and possibly never been to Chiriquí. This attitude can be reflected in the way farmers see and treat their land, not having much concern for its health and future fecundity because they do not feel deeply rooted to the region.

Similarly, there are many problems with land titles. Many farmers do not own the land that they work and therefore do not know much about it (i.e. it's physical condition/health, size, amount devoted to forest). It would be advantageous for these farmers to be given the opportunity to work towards buying their own land, though with current land prices this seems like an uphill battle.

### *6.3 Finance*

The implementation of an avoided deforestation credit program will certainly be appealing to most of the farmers interviewed in this research. The downfall is that this type of program will only be beneficial to those farmers who have land titles and will therefore have no effect on these farmers without.

Other than culantro and cattle ranching these farmers have very few options as far as generating income. A group of students from Texas have recently come to El Valle,

working with Earth Train in the hopes of setting up an infrastructure for families to grow and sell ornamental plants, using small organic home-gardens. Many families opted to have the flower beds built and are excited about the project, but still weary of whether the infrastructure will ever actually be set up.

Within the next 5 years the road from Chepo to El Valle should be completed and paved, allowing for easier access by all vehicles. When this is completed some sort of public transportation, other than the chiva, will increase the export of culantro from the area while greatly reducing transportation costs. There is also talk about Japan having an interest in dried culantro from Panama. Though this sounds far-fetched it could open up money making opportunities and contracts for some of the farmers in the area. Currently, however, for increased yields farmers must adopt new growing techniques with lower inputs. Using a model such as the inputs used by Farmer 8, other farmers could greatly reduce their farm maintenance costs.

#### *6.4 Final Recommendations and Conclusion*

Most important when dealing with these communities and the environmental, social and financial aspects of cultivating culantro is increased education about their role in the ecosystem and ultimately more formal research on culantro. Future research should involve physical requirements of the plant; nutrients, sun water and soil type. There also needs to be more research on the social motivations for growing culantro and other feasible substitutes for the areas farmers.

Culantro is the main source of income for these people and therefore all aspects of its cultivation are of great importance for the future financial and social stability of the area. With more education available to farmers based on more thorough research about

the plant, farmers in the future can make informed decisions of how to manage their parcels, ultimately increasing the quality of the local environment and security of the surrounding forest.

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**APPENDICES**

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## APPENDIX 1: Interview Outline

### Interview Outline

Topics	Questions
Personal History: <ul style="list-style-type: none"> <li>• Years in current location</li> <li>• Origin</li> <li>• Growing culantro</li> </ul>	<ul style="list-style-type: none"> <li>• How long have you lived here?</li> <li>• Where did you come from?</li> <li>• How long have you been growing culantro?</li> </ul>
Inputs: <ul style="list-style-type: none"> <li>• Water</li> <li>• Chemicals (fertilizer &amp; pesticides)</li> <li>• Labor</li> </ul>	<ul style="list-style-type: none"> <li>• What are the major inputs for growing culantro?</li> <li>• Do you use an irrigation system, chemical fertilizer, pesticides and or hired labor for the cultivation of culantro?</li> <li>• What are the costs of these inputs?</li> </ul>
Land: <ul style="list-style-type: none"> <li>• Size</li> <li>• Amount devoted to culantro</li> <li>• Forest</li> <li>• Titles</li> </ul>	<ul style="list-style-type: none"> <li>• Do you own the land you farm?</li> <li>• How many hectares is your farm?</li> <li>• How many hectares are devoted to culantro production?</li> <li>• How many hectares are in forest?</li> </ul>
Economics: <ul style="list-style-type: none"> <li>• Selling price</li> <li>• Transport</li> <li>• Annual fluctuations</li> <li>• Buyers</li> </ul>	<ul style="list-style-type: none"> <li>• What are the highest and lowest prices you receive for culantro throughout the year?</li> <li>• What are the prices for transportation?</li> <li>• Where do you sell your culantro?</li> </ul>
Problems: <ul style="list-style-type: none"> <li>• Pests (fungus, insects &amp; disease)</li> <li>• Water</li> <li>• Competition</li> <li>• Transport</li> <li>• General care</li> </ul>	<ul style="list-style-type: none"> <li>• What are the greatest problems involved with growing culantro?</li> <li>• Does transportation limit the amount of culantro which you can sell?</li> <li>• How do you deal with these problems?</li> </ul>
Motivation	<ul style="list-style-type: none"> <li>• Why culantro?</li> <li>• Have you ever considered switching to a different crop?</li> </ul>

*(Box 1: Outline of Topics and Questions covered during informal interviews)*

**APPENDIX 2: PICTURES**

*(Picture 1: Cut Culantro)*



*(Picture 2: Culantro in Field with Seeds)*



*(Picture 3: Section of Road between El Valle and La Zahina, Crossed by the Mamoni River)*



*(Picture 4: Open Field Cultivation in El Valle)*



*(Picture 5: Bed Cultivation in El Valle)*



*(Picture 6: The Chiva transporting Culantro from El Valle to Chepo)*

## APPENDIX 3: Work Schedule

January						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

March						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

April						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

**January:** 24-27: Initial Meetings with CREA/Research, Avg. 1.5hrs/day

= **6hrs**

**February:** 14-21: Work plan, Avg. 1.5hrs/day = 12hrs

28-29: Market Visits, 4hrs each = 8hrs

= **20hrs**

**March:** 1: Market Visit, 4hrs

8-13: Field Visit/Data Collection (El Valle), Avg. 8hrs/day = 48hrs

20: CREA Meeting/Data Organization = 4hrs

21: Data Organization = 2hrs

= **58hrs**

**April:** 8-12: Field Visit/Data Collection (La Zahina), Avg. 8hrs/day = 40hrs

14-22: Working on Paper and Symposium, Avg 8hrs/day= 64hrs

23: Symposium, 6hrs

24-25: Finishing Paper, Avg. 8hrs/day = 16hrs

=**134hrs**

**TOTAL: 218hrs**

**APPENDIX 4: Budget**

<b>Purpose</b>	<b>Cost (per person)</b>	<b>Total</b>
Transportation to Field (Two round-trips)	\$23.00	\$46.00
Transportation to Markets (Three round-trips)	\$9.00	\$18.00
Lodging (Hotel in Chepo)	\$6.00	\$12.00
Food	\$40.00	\$80.00
Printing and Photos for Interviewed Farmers		\$30.00
<b>Total</b>		<b>\$186.00</b>