AN EVALUATION OF THE ADOPTION OF GOOD AGRICULTURAL PRACTICES AND FOOD SAFETY PRACTICES AMONG SMALL-SCALE CAPE GOOSEBERRY (PHYSALIS PERUVIANA) FARMERS IN BOYACÁ, COLOMBIA

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ABSTRACT

Concerns over food safety have spurred an increase in farm production and supply chain management protocols for fresh produce. Foodborne illness outbreaks, increased consumer demand for safe food, and government requirements for due diligence have caused retailers to develop stringent protocols in the production and handling of fresh foods. These requirements, though known as private voluntary standards (PVS), are often essential to accessing global markets. In many developing countries, public and private sector stakeholders are investing in food safety compliance among small-scale farmers. One important voluntary standard for fresh fruits and vegetables is the Global Partnership for Good Agricultural Practices, GLOBALGAP (formerly EUREP-GAP). Within developing countries, compliance with private voluntary standards often presents formidable challenges as well as opportunities for the small-scale farmer. In Colombia, *Physalis peruviana* is a promising exotic fruit produced almost exclusively by small-scale farmers, and the farmers are engaging in different production strategies to meet market requirements. While known as 'uchuva' in Colombia, it is commonly known as cape gooseberry or ground cherry in English-speaking countries. In Colombia it is produced primarily for export markets and has potential for expanding export revenues and helping to stimulate the rural economy. In order to strengthen their market competitiveness, some small-scale producers are working with public and private sector entities to improve their production and handling practices and to meet international market requirements for a clean and safe food supply. In this study, a survey was administered to 27 small-scale cape gooseberry growers in the Márquez region of Boyacá, to evaluate their strategies of adoption good agricultural practices (GAP) and food safety practices. Results indicated that growers who worked within farmer groups and were linked to farmer support institutions were able to successfully adopt formal GAP and food safety protocols, and improve their farm management and productivity. The results also indicated that the adoption of such practices, though requiring considerable capital investment, had beneficial effects on the farmer, farm workers, fruit quality and productivity.

BIOGRAPHICAL SKETCH

CaSandra Marie Carter was born and raised in Chicago, Illinois, where she first began her studies in agriculture at the Chicago High School for Agricultural Sciences. She went on to receive a Bachelor of Science in Biosystems & Agricultural Engineering at the University of Minnesota in 2000. CaSandra has worked for Green Giant, General Mills, and as a missionary with InnerCHANGE, an international organization. Her work with InnerCHANGE as well as her international volunteer experience led her to encounter global poverty and hunger around the world, and fueled a desire to explore how agriculture could be used to help meet the needs of the world's poor. This led CaSandra to enroll in a Master of Science program in Horticulture at Cornell University in August, 2007.

In loving memory of my grandparents, Legus and Mary Hibler, the best people I’ll ever know.

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LIST OF ABBREVIATIONS

AAP	Apoyo Alianzas Productivas
ADP	Alternative Development Program
ANOVA	Analysis of Variance
ASOHOFRUCOL	Asociación Hortifrutícola de Colombia
BSE	Bovine Spongiform Encephalopathy
CCI	Corporación Colombia Internacional
CCP	Critical control point
COP	Colombian pesos
DFID	Department for International Development
EGAP	Exporter good agricultural practices farmer group
EU	European Union
EUREP-GAP	European Retailers Working Group on Good Agricultural Practices
FFV	Fresh fruits and vegetables
FNFH	Fondo Nacional de Fomento Hortifrutícola
GGAP	GlobalGAP certified farmers
GAP	Good agricultural practices
GFSI	Global Food Safety Initiative
GLOBALGAP	Global Partnership for Good Agricultural Practices
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HSD	Honestly Significant Difference
ICS	Internal control system
IFS	International Food Standard
ISO	International Organization for Standardization
NGO	Non-government organization
NOGG	Non-GAP certified farmers
PROCAVEN	la Asociación de Productores de Ventaquemada
PROEXPORT	Colombian Export Promotion Agency
SENA	Servicio Nacional de Aprendizaje
SPS	Sanitary and phytosanitary
SQF	Safe Quality Food
UK	United Kingdom
US	United States
USAID	United States Agency for International Development
USD	United States dollars

CHAPTER1

FOOD SAFETY AND SMALL FARMERS: REVIEW OF LITERATURE

Introduction

Insuring the microbial food safety of fresh fruits and vegetables (FFVs) has increasingly become a priority among consumers and within the fresh produce industry on local and global scales. Microbial contamination of FFVs poses significant health and financial risks. Foodborne illness outbreaks over the past decade have caused a surge in protocols of how FFVs are produced, harvested, packaged and traced, in order to reduce occurrence and spread of microbial contamination and health risk to consumers. A recent example was the spinach *Escherichia coli* outbreak during the summer of 2006, which killed several people, caused illness for hundreds more, and cost the California spinach industry an estimated $800 million (Blake 2007). In January 2010, *The Packer*, a weekly newspaper covering the North American fresh produce industry, reported that food safety issues ranked No. 1 in their 2007 and 2008 top news events, and food safety reform efforts ranked as the second-most important story of 2009 (Galbraith, 2010).

Ensuring food safety is a priority for the U.S. government. In 2009 President Barack Obama established a panel to develop the new food safety rules for eggs, poultry, beef, leafy greens, melons and tomatoes, and to improve coordination and communication among the agencies overseeing the safety of the nation's food supply (Jalonick 2009). On January 4, 2011, President Obama signed a new legislation, the Food Safety Modernization Act. The Act is the most significant US food safety legislation in 70 years (Pendrous 2011), taking a more rigorous evaluation of processes and controls within food supply chains. The 89-page legislation includes requirements for produce safety, such as the use of good agricultural practices (GAPs) in FFV production and handling (FDA 2011). Speaking at the Food and Drug Law Institute in Washington, DC, Michael Taylor, the US Deputy Commissioner for Foods, said the Act is intended to "*... build a new system of food safety oversight that looks at the food system as a whole and marshals the efforts not only of FDA but of government at all levels and actors throughout the food system to improve food safety"* (FDA, 2011). At the Global Food Safety Conference in London he recently stated that the Act represented "*really sweeping food safety reform regulation*", in moving to a risk-based approach to inspection. "*Accredited third-party certification will play a crucial role*," said Taylor (Pendrous 2011). *"The critical issue is to ensure importers ensure their suppliers have the systems in place to ensure safe food*" (Pendrous 2011). The legislation has important implications for domestic as well as international suppliers of FFVs to US markets.

Furthermore, reform over food safety, environmental protection, worker and animal welfare has been under considerable development over the past several decades in Europe (Hobbs et. al., 2002). Legislation introduced in 1990 in the United Kingdom (UK) held retailers liable for practicing "due diligence" in ensuring the safety of their products, including FFVs. Additionally, the 1996 discovery of "mad cow disease," Bovine Spongiform Encephalopathy (BSE), in British herds heightened food safety concerns (Bell and Shelman, 2009; Brown and Sander 2007). The BSE crisis elicited rampant consumer demand for food safety protection, and according to Bell and Shelman (2009), the crisis changed attitudes within the boardrooms of major European retailers. The realities of consumer demands along with government-imposed regulation spurred the inception of a new universal production standard among food retailers in the UK. In 1997, the European Retailers Working Group Good

Agricultural Practices (EUREP-GAP) standard was created to provide a harmonized standard for food safety and traceability, to calm consumer concerns about pesticides, food hygiene, environmental protection, and worker welfare (Brown and Sander 2007; Vorley 2003). In September 2007, the EurepGAP standard's name was changed to the Global Partnership for Good Agricultural Practices (GlobalGAP), to reflect the international scope of activities across national boundaries (Bell and Shelman, 2009). The standard covers agricultural crops, livestock, aquaculture and feed manufacuturing (GLOBALGAP, 2011).

As investment in the agricultural sector continues to be an important item on the development agenda, many governments, non-government organizations (NGOs) and international development institutions are focusing on strategies for linking small-scale farmers in the developing world to domestic and export markets (Berdegue et al., 2008). The 2008 World Development Report highlighted agriculture as a major component in the economic growth and development of poor countries (World Bank 2008). The report emphasized the need for investment in the rural sector for poverty alleviation, food security, and sustainable livelihoods.

Improved technical capacities in food safety and sanitary and phytosanitary (SPS) controls were among the strategies for creating stronger market access for smallholder farmers. Some countries that desire to become more competitive in global horticultural markets, and stimulate economic growth within their rural sectors are implementing GAPs programs among their producers (Berdegue et al., 2008; Santacoloma and Riveros, 2002; van der Valk and van der Roest, 2009). Small-scale farmers play an important role in this process, as they comprise the majority of farmers producing FFVs. They often have a comparative advantage in producing labor-intensive FFVs, which can provide a relatively high economic return (Brown and Sander 2007). However, obstacles to compliance with strict SPS standards of international buyers are real concerns (FAO/WHO 2005; Humphrey, 2008; Unnevehr and Hirschhorn, 2000) . Growing demand for FFVs and heightened concerns over the production and delivery of safe foods provide opportunities as well as challenges for small-scale agriculture.

Food Safety and Small Farms

The production and delivery of clean and safe food products is a basic requirement for success on the global market (FAO/WHO, 2005). Small-scale producers operate with different constraints in comparison to large-scale farming (Stanton and Burkink 2008). Small-scale farmers, in both the US and countries around the world, often grow multiple crops with a diverse set of cropping systems and farm operations (which may include some livestock, chickens, etc.,) on limited acreage. These smaller farms are limited by product volume and often lack the capital investment for food safety compliance (Brown and Sander, 2007; Narrod et al., 2009; Stanton and Burkink, 2008). Indeed, this reality is even more exacerbated for small farmers within developing countries, who often farm on considerably less area of land with fewer resources than those of small farmers within the US (Stanton and Burkink, 2008). Farming within such conditions makes it difficult to comply with intricately detailed protocols for each crop which, for example, under some food safety programs may include complying with up to 100 compliance criteria for a single crop (GLOBALGAP, 2011). In the US, small farmers are increasingly becoming vocal about the impacts of heavy food safety regulation, arguing that they are already much more accountable to their customers for the quality of their farm product than are mass-production facilities, and that they will be forced out of business under the weight of well-meaning regulation aimed at larger agribusinesses (Luntz, 2009).

While small farmers in the US encounter challenges with food safety regulation, small-scale farmers in developing countries face completely different and more complex constraints. Capital investment, infrastructure challenges, technical assistance, market information, and access to credit are a few. However, failure to meet the challenges of food safety certification may undermine farmer livelihoods and market-oriented development strategies (Humphrey, 2008) . Humphrey (2008) described some of the concerns with the enforcement of food safety regulations upon small horticultural farmers in Kenya as:

- Small farmers are less likely to have the financial resources for investment in new equipment, such as latrines, washing facilities and pesticide storage.

- Small farmers' ability to adopt new techniques, such as integrated pest management and crop rotation, is likely to be more limited.

- Both the startup costs and the recurrent costs of certification itself would be relatively high for small farms – relative to the revenue from their sales and to their capacity to make the upfront investment in systems development and certification.

- Small farms tend to have less sophisticated farming systems than large farms. Therefore the capacity of these farmers to meet the documentation, traceability and skill requirements of GLOBALGAP would be less than for larger farmers.

- African countries are particularly vulnerable to the development of private voluntaray standards (and food safety standards more generally) because the food safety protocols are less well-developed than those in competitor countries.

Microbial Food Safety of Fresh Fruits and Vegetables

Giovannucci and Reardon (2001) describe standards as “defined parameters that segregate similar products into categories and describe them with consistent terminology that can be commonly understood by market participants” (Trienekens and Zuurbier, 2008). Though this may be the formal understanding of a ‘standard,’ in today’s milieu of food safety reform, these “defined parameters” are constantly changing in response to the dynamic realities of globalized food supply chains, increases in scientific knowledge about food safety risks, and increasing consumer and retailer demands (Berdegue et al., 2008; Hobbs et al., 2002; Humphrey, 2008). Several developing countries have been creating national GAP implementation programs in order to meet international market requirements (UNCTAD, 2007). In some cases national governments, such as Kenya, Mexico, Chile and Malaysia have developed their own set of national GAP schemes and are benchmarking (or, harmonzing) them to the GLOBALGAP standard. Although challenges exist for developing country farmers, studies have shown that compliance with food safety standards is possible and the resulting access to export markets can provide a opportunity for economic and social development gains (UNCTAD, 2007). Donors and international development organizations often support projects which focus on improving the production and export of FFVs as a strategy for poverty alleviation and rural development. Some of the countries involved in such strategies, to be discussed in a later section, provide examples of successful adoption through national GAP benchmarking certification as well as small-scale farmer group certification.

Private Voluntary Standards and Food Safety

Private voluntary standards coexist along with government systems of food safety regulations (Humphrey, 2008). While national governments determine their own regulations, they are required to meet the standards of their export countries. There are many global initiatives and some retail brands which promote standards for safe foods. Table 1 shows examples of of private standards which have gained some recognition in international food markets. As food safety standards continue to evolve on global scales, the primary strategy for compliance among producers of FFVs is the development and adoption of GAP protocols (Henson and Jaffee, 2008; Kleinwechter and Grethe, 2006; Will, 2010). As the EU continues to be a major importer of FFVs from developing countries, there has been a strong trend towards the adoption of the GLOBALGAP standard , the most widely implemented farm certification scheme in the world (Bain 2010; Eurofruit Magazine 2008).

GLOBALGAP

The GLOBALGAP standard continues to gain prominence as the leading private voluntary standard for the access of agricultural commodities to major import markets (Will, 2010). The standard provides specific application for different product ranges, including fruits and vegetables, flowers and ornamentals, coffee, tea, livestock and aquaculture (GLOBALGAP, 2011). As of February, 2011, over 100,000 producers in more than 100 countries were GLOBALGAP certified (GLOBALGAP, 2011). Currently, GLOBALGAP is the leading food safety standard for food retailers in Europe, many of whom have many suppliers in developing countries in Asia, Africa and Latin America. Formed by European retailers, it is a private sector body that sets voluntary standards for the production processes of agricultural products around the globe. The GLOBALGAP standard is primarily designed to reassure consumers about how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health, safety, and animal welfare (GLOBALGAP, 2009). GLOBALGAP is a prefarm-gate standard, which means that the certificate covers all production, harvest and post-harvest activities until the crop leaves the farm. It is a business-to-business label and is therefore not directly visible to consumers (GLOBALGAP, 2009).

Table 1 – ***Examples of Private Standards in Food Safety and/or Private Food Quality Label***

Individual firm schemes	**Collective national schemes**	**Collective international schemes**
Carrefour Filière Qualité	Assured Food Standards	GLOBALGAP
Earthbound (US)	British Retail Consortium Global Standard - Food	International Food Standard (IFS)
Fresh Express (US)	Food Safety Leadership Council (US)	Global Food Safety Initiative (GFSI)
Ready Pac (US)	The Leafy Greens Council (US)	ISO 22000:Food safety management sytems
Tesco Nature's Choice	QS Qualitat Sicherheit	Safe Quality Food (SQF) 1000 and 2000
Whole Foods Market Brands (US)	Label Rouge	ISO 22005: Traceability in the feed and food chain
	Food and Drink Federation/British Retail Consortium Technical Standard for the Supply of Identity Preserved Non-Genetically Modified Food Ingredients and Product	

Source: Adapted from WTO (2007:2), with relationships in columns only.

As mentioned previously, the GLOBALGAP standard places an emphasis on food safety, environmental protection, and worker and animal welfare. The standard is module-based (covering crops, livestock and aquaculture), containing a set of critical control points (certification criteria) for specific groups of agricultural commodities (such as FFVs). The critical control points (CCPs) are the evolving standards which are designed to ensure the safe production and handling of agricultural crops, as well as to reduce adverse environmental impacts, and provide critical sanitation and other facilities for farm workers. Under the GLOBALGAP module for FFVs, farmers are required to comply with CCPs covering the following five areas: i) propagation material; ii) soil and substrate management; iii) irrigation/fertigation; iv) harvesting and; v) produce handling. Each of the control points under these key areas has a recommendation level of 'major must' or 'minor must.' Farmers are required to comply with 100% of the 'major must' control points and 95% of the 'minor must' control points.

There are four different certification options for GLOBALGAP: i) individual producer; ii) producer group; iii) benchmarking – individual, and; iv) benchmarking – group. The "benchmarking" options allow certification of existing GAP programs which meet GLOBALGAP certification criteria. Some countries are working to benchmark their national GAP programs to the GLOBALGAP standard. According to GLOBALGAP (GLOBALGAP 2011) the benchmarking process 'consists of a one-to-one comparison principle where private or public schemes existing in different regions or countries are contrasted with GLOBALGAP. These schemes usually address certain requirements identified for the particular geographical locations and marketplace. They also reflect the local regulations, needs and cultures and often have brand image attached to them.'

Currently, the most common approach for implementation of GLOBALGAP among small-scale farmers in developing countries is to use the producer group certification, or Option 2. Under the Option 2 certification, farmer groups are required to be a registered legal entity (registered with their local government), and they must develop a quality management system (QMS) adopted by the whole group. The QMS must comply with all of the requirements as set out in the GLOBALGAP QMS checklist. Furthermore, the farmer groups must develop an internal control system (ICS) for monitoring the group's compliance. The certification evaluation process is essentially divided into two elements: i) audit of the group's QMS and ii) inspection of a sample of registered producers by a certified body (a third-party GLOBALGAP certification body). The inspection sample size for the registered farmer group is the square root of the total group membership. Certified farmer groups undergo one announced audit per year, and one unannounced audit per year (to be determined by the certification body). The combination of Option 2 and benchmarking of other GAP certification efforts are the primary strategies being used to increase adoption of the GLOBALGAP and/or other food safety standards and incorporate small-scale producers into global value chains (Bain, 2010; Brown and Sander, 2007; Narrod et al., 2009).

Food Safety Management by Small-Scale Farmers

In an effort to ensure the competitiveness of small-scale farmers in today's global marketplace for FFVs, developing countries are investing in the implementation of GLOBALGAP certification. Small-scale producers in developing countries have often been ill-equipped to achieve the type of farm management required to reduce risks of microbial contamination within their production. Access to capital, technical assistance, documentation training, clean water, hand-washing facilities, worker restrooms and traceability systems are some of the key resources needed for compliance (Narrod et al., 2009; Will, 2010).

Kleinwechter and Grethe (2006) conducted a study that assessed the factors that influenced the adoption of GLOBALGAP by mango exporters in Piura, Peru. They identified three stages in the process of producer compliance with the standard: (i) the information stage; (ii) the decision stage; and (iii) the implementation stage. Access to information was the first major barrier to the adoption of the standard. Direct contracting with an exporter was the key factor for a favorable decision to adopt the GLOBALGAP standard. Exporter partnerships played an important role in the adoption process, given that the cost of compliance during the implementation stage was the most common inhibitor. Indeed, multi-sector partnerships, including government, private sector and civil society organizations, can provide the much needed support for small-scale producers throughout the implementation process. According to Berdegue, Bienabe and Peppelenbos (2008), participation in global markets by small-scale farmers in developing countries depends upon: i) collaborative arrangements between trained and organized farmers, ii) a receptive business sector, and iii) conducive public polices and programs.

Approaches Implemented by Developing Nations

Although there is an abundance of research on the proliferation of food safety standards and the potential impacts on developing world producers, the available literature on small-scale farmers' interface with the implementation process is limited. Many case studies provide helpful macro-level institutional and policy contexts for countries which have made advances in GAP and food safety compliance for FFVs (Bain 2010; Henson and Jaffee, 2008; van der Valk and van der Roest, 2009). Other studies provide empirical and/or qualitative evaluations of some of the impacts and/or characteristics of small farmers who successfully attained certifications (Humphrey, 2008; Kleinwechter and Grethe 2006; Jin and Zhou, 2010). A study by van der Valk and van der Roest (2009) compared four countries, Kenya, Malaysia, Mexico and Chile, in their experiences in the adoption of GAP standards. The study provided historical contexts for the development of national GAP programs which ultimately led to GLOBALGAP benchmarking. In all cases, the development of GAP programs were realized through government, private sector, civic organizations, and (in some cases) donor agency partnership. Kenya, Mexico and Chile established national GAP schemes which were successfully benchmarked to GLOBALGAP over the course of two year processes, and Malaysia established national GAP schemes to meet national and regional food safety requirements. However their strategies were developed by large producers (bottom up) and then endorsed by their governments (van der Valk and van der Roest, 2009). Kenya, however, has shown success in integrating small-scale farmers into GAP certification programs and global supply chains through an array of joint public-private sector initiatives to train growers in all aspects of GAPs (Henson and Jaffee, 2008).

A study by Will (2010) provides helpful insight into small-scale farmers' experiences in the adoption of the GLOBALGAP Option 2 (farmer group) certification in Kenya, Ghana, Thailand and Macedonia. In all four countries, pilot testing of GLOBALGAP certification activities were implemented through development programs by partnering organizations; the German organization, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the UK Department for International Development (DFID), and the United States Agency for International Development (USAID). The purpose of the development programs was to integrate smallholder farmers into food supply chains. The study implemented a "stepwise action-oriented approach” to small-scale farmer groups. That is, in each location the following consecutive steps were taken: i) group profiling and selection of farmer groups according to pre-established eligibility criteria; ii) assignment of a local coordinator for managing the pilot project and group of instructors; iii) kick-off workshop; iv) group work – training assessment, attendance of tailor-made training courses; v) mid-term review – jointly implemented by GTZ, GLOBALGAP and development partners; vi) implementation of the groups’ internal control systems (ICS) and vii) final workshop – jointly implemented by GTZ, development partners, the local coordinator, farmer groups’ manager and the instructors. The pilot projects provided time periods for evaluation and reflection during the process, allowing the project partners to adapt the implementation according to the progress of farmer groups and the instructors involved in the training. The study found that the pilot project attained significant impacts with regard to building technical and managerial capacities of farmers and group managers. Furthermore, a post-pilot evaluation in Ghana showed that the majority of pilot farmers increased their incomes through increased productivity and reduced production costs under the GLOBALGAP group certification.

Hortico Agrisystems, a small-scale exporter enterprise in the Mashonaland East region of Zimbabwe, contracts with small-scale farmers to grow baby corn, butternut squash, fine beans, sweet corn, broad beans and chilies (Henson et al., 2005). This company plays a critical role in the success of the adoption of GLOBALGAP among its small-scale producers, as it provides the GAPs training and assistance, inputs and monitoring. However, Hortico Agrisystems has a selection process that farmers must undergo if they are to grow for them, which may marginalize many farmers who do not meet the minimum requirements. The farmers are screened to ensure that they have the required resources (mainly land, labor and water), abilities and commitment to supply under the strict production standards specified by Hortico Agrisystems. They are also subject to a strict system of enforcement, where anyone caught cheating or failing to comply with the required production procedures is given a maximum of two warnings, following which they are removed from the contract. Hortico Agrisystems also makes use of producer competitions as positive incentives for high levels of performance (Henson et al., 2005).

In India, the Mahagrapes marketing group is facilitating GLOBALGAP adoption among small-scale producers (Narrod et al., 2009). Mahagrapes is a marketing partner to a group of grape producer cooperatives in the Maharashtra state of India. Mahagrapes is a marketing enterprise that negotiates better prices for its members and also provides technical assistance,training, inputs and information to the farmers to enable them to meet international food safety requirements (Roy and Thorat 2008). Mahagrapes facilitates all of the required marketing information, direction and capabilities for its farmer cooperatives, providing marketing expertise, negotiating contracts, supplying GLOBALGAP certification, and purchasing inputs in bulk (like bio-fertilizers) or through in-house production, at significantly reduced prices (Roy and Thorat, 2008). The organization has managed to provide their entire group of cooperatives with GLOBALGAP certification, however the certification is based upon the farmer's relationship to Mahagrapes. Farmers would not retain their existing certification status if they were to sever their relationship from the Mahagrapes.

Export and Small Farms of Colombia

Another country that is making considerable effort to invest in its rural sector to meet the challenges of international food safety standards is Colombia. Colombia's unique geography and climate enables a permanent fruit and vegetable production throughout the year (Caballero, et al. n.d.). This provides a comparative advantage in the ability to provide FFVs to global markets year round and presents a significant growth opportunity for the agricultural sector. The small farm economy plays a key role in Colombian rural food security and in total national agricultural output (UNEP, 2005). Small-scale farmers produce approximately two thirds of all national agricultural output in Colombia, the proportion of which increases if illegal crops (coca and opium poppies) are included (Table 2) (Bojanic 2001; UNEP 2005).

Table 2 – Small farm share of agricultural production in Colombia, 1999 - 2000

Concept	**Type of farm**	**Including coca and poppy production (%)**	**Without coca and poppy production (%)**
Area cultivated	Small farms	68.1	67.3
	Commercial farms	31.9	32.7
Crop value	Small farms	69.1	62.9
	Commercial farms	30.9	37.1

Sources: Forero, 2003, calculated from statistics of the Ministry of Agriculture and FEDCAFE. For coca and amapola: Áreas Policía Nacional, Tavera 2000, in United Nations Food and Agriculture Organization, The World Bank, and the United States Agency for International Development, 2003.

Overview of the Implementation of Good Agricultural Practices (GAPs) and Food Safety Compliance in Colombian Fruit & Export

Over the past several years there have been national efforts in Colombia to assist in sustainable production and export capacity among small-scale producers, and stimulate the rural economy (Mejia, 2005; Cannock et al. 2006, Caballero, et al. n.d.). These efforts are in accordance with "Visión 2019", a national agenda designed by the National Planning Department (DNP 2005). The plan aims to make more efficient use of tropical comparative advantages and promote processes with higher added value, primarily through technological innovation to strengthen access to international markets (UNEP 2005). Government programs and multi-sector partnerships were forged to improve the market competitiveness of the rural sector. Programs launched by the Ministry of Agriculture, state governments, Asociación Hortifrutícola de Colombia (ASOHOFRUCOL, the Colombian Horticulture Society), the Servicio Nacional de Aprendizaje (SENA, a national training service), Fondo Nacional de Fomento Hortifrutícola (FNFH), Corporación Colombia Internacional (CCI), and others are partnering for market-oriented capacity-building among small-scale farmers (Avendano, 2009).

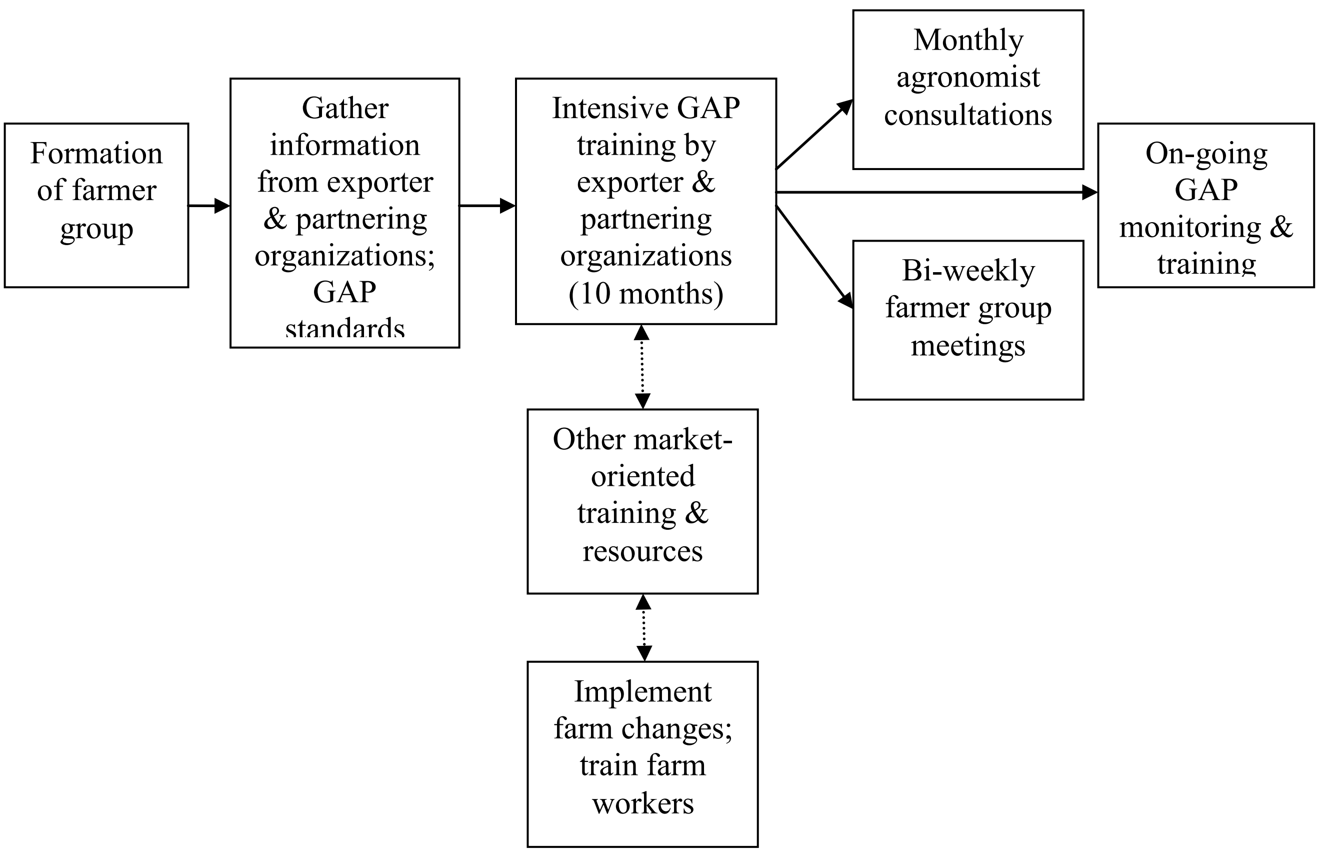
The Department (similar to state) of Boyacá is making progress in the implementation of the GLOBALGAP certification among small-scale farmer groups. Local technical assistance programs such as Agromárquez (a rural development initiative of the Ministry of Agriculture) and Crecer (a rural economic development program) are just a couple of examples of programs that are working on the implementation of GAPs in Boyacá. In many cases local programs are working in collaboration with other state and national organizations, to provide coordination of time and resources. Their collaborations provide resources including but not limited to: technical assistance in topic-specific training (i.e., disease management, pruning, harvesting, etc.), GAP coordinators, GAP trainings, and market requirement information, consultations, and business development planning. Additionally, exporters partner with some of these organizations to strengthen communication about market requirements, training needs, and to develop special pilot projects (Universidad Nacional de Colombia 2007). Agromárquez is working in partnership with the SENA, ASOHOFRUCOL, FNFH and the Gobernación de Boyacá (the Boyacá state government) to implement the GLOBALGAP standard and increase the export of exotic fruits. Agromárquez, as well as other programs within the state, are working with farmer groups to implement the GLOBALGAP farmer group certification scheme.   Geographically, the program covers the Márquez province, a central region of Boyacá, including farming communities in 11 municipalities. Farmers are forming producer groups to provide economies of scale and share in training and expenses (Pineiro and Diaz Rios 2007; Santacoloma and Riveros 2002). The criteria of the GLOBALGAP farmer group certification option requires farmer groups to be registered as legal entities with the local government. The farmer groups in Boyacá are registered with the local municipalities, have elected officers and meet regularly to address production issues, attend trainings, and to work together towards improved production and harvesting. Farmers are accessing a network of resources through the use of public-private partnerships, in order to obtain information on improved production and harvesting of export crops. For example, in some cases farmers are receiving GAPs training from exporters, crop budget assistance from the state government, and technical assistance from hired agronomists.

The Boyacá state government also provides assistance in areas such as financial planning, technical assistance, as well as group formation. In some cases there is an overlap in services, where several programs provide similar types of services. This, however, does not seem to pose a conflict with existing programs, as the levels of needs within the region perhaps exceed the number of available resources. The situation does, however, warrant a closer examination of the strategic localities of each of the programs and services. Most state government resources are located in or near the capital city of Tunja, while a few are located in the smaller municipalities, closer to the farmers' homes and planting sites. It is understood that the remote nature of the farming communities, the limited infrastructure (very rough, unpaved and/or limited roads) and limited transportation are some of the important barriers to setting up resource centers directly within the farmer communities.

The Exporter GAP Process

The process for farmers following exporter GAP protocols could be generally characterized by the events described in Figure 1. The diagram shows a very broad view of a process that is replete with intermediary activities, processes and cirmcumstances which impact the process. Exporters play a major role in the process and their investment and presence as a sure buyer provide a great a incentive for harnessing the interest and participation of local farmers.

Figure 1 – ***Farmer Group Process for the Implementation of Exporter GAP Protocols in Márquez region of Boyacá, Colombia***



As market requirements for FFVs continue to change, countries are striving to adapt and meet the challenges. Market demand is no longer confined to local or regional supply, as retailers now source their products from all over the world (Trienekens and Zuurbier, 2008). Food safety standards continue to play a major role in the economic success of suppliers of FFVs, and developing countries are taking steps to find ways to maintain or increase their market competitiveness. Strategic options in compliance will vary across countries, reflecting economic, political and social systems and norms, institutional structures, geographical size, etc. (Henson and Jaffee, 2008). Countries such as India, Zimbabwe, Colombia, and the GLOBALGAP implementation pilot project in Kenya, Ghana, Thailand and Macedonia provide interesting examples of strategies for food safety certification and integrating small-scale producers into global supply chains. Though the presented cases have been limited in their scale and scope, and there is indeed need for further research on small-scale farmer experiences in GAP adoption processes, it is evident that there is an emergence of initiatives to address SPS requirements within developing countries. In all cases of adoption processes, there was public-private sector investment, and in some cases donor agency investment.

Quite naturally, the question of sustainability emerges when considering the reliance upon multiple partners for GAP program success. Will small-scale farmer groups be able to maintain their certifications, for example, if one of its partner organizations loses its funding or shifts its development priorities? Will potential market volatility, changes in consumer preferences or other market shocks threaten the livelihoods of such farmers, even with food safety certifications? Such questions need to be addressed through further research, multi-sector dialogue, and long-term investment, monitoring and evaluation of small-scale farmer experiences in international markets.

CHAPTER 2

THE PRODUCTION AND EXPORT OF CAPE GOOSEBERY (PHYSALIS PERUVIANA) AMONG SMALL-SCALE FARMERS IN BOYACÁ, COLOMBIA

Introduction

Colombia is the third-ranked country in the world in terms of biodiversity, and its unique geography and climate enables agricultural production throughout the year (Bayer CropScience 2006). Exotic fruits grow in moderate to cold climates over the vast geographic landscapes throughout the country and are an expanding component of Colombia's export diversification. As part of Colombia's effort to promote economic growth and development within its rural sector and among small-scale growers, national and local initiatives focus on strengthening farmers' technical capacities and market competitiveness. One strategy has been to improve production and handling practices for exotic fruits which have been identified as economically 'promising' in international markets. The promising fruits include tree tomato (*Cyphomandra betacea sendth*), cape gooseberry (*Physalis peruviana*), pitahaya (*Hylocereus trigonus*), baby banana (*Musa acuminata*) and granadilla (*Passiflora ligularis)* (Pineiro and Diaz Rios, 2007). Through the promotional efforts of the Colombian Export Promotion Agency (PROEXPORT), these non-traditional agricultural products (or specialty crops) have gained international market success and provide high returns to farmers. PROEXPORT's mission is to contribute to national economic growth through the promotion of exports of goods and services, international tourism, and foreign investment in Colombia. Over the past two decades their efforts in promoting Colombia's exotic fruits in international markets have contributed to the growing success of Colombia's agricultural exports (Mejia, 2005). Cape gooseberry continues to gain increasing market demand, particularly in Europe where export revenues are strong and retail prices provide attractive incentives for importing companies (Tables 3 and 4).

Table 3 - Colombian Export of Cape Gooseberry (accumulative, June 2006)

Destination country	**Thousands of $USD FOB**		**Tons**	
		%		%
Germany	3,678	30	1036	32
Holland	3,227	27	908	28
Belgium & Luxemburg	2,311	19	593	17
Sweden	763	6	206	6
United States	311	3	56	2
United Kingdom	638	5	158	5
France	619	5	186	6
Other countries	589	5	134	4
Total	12,136	100	3277	100

Source: DIAN-DANE, calculations by Corporación Colombia Internacional

Table 4 - Average Cape Gooseberry Retail Price of European Importers, 2006

Destination country	**Average FOB Price per kg**
Belgium	$9.58
Denmark	$11.89
France	$9.07
Germany	$7.05
Holland	$7.05
Switzerland	$10.93
Sweden	$8.66
Italy	$7.05

Source: Corporación Colombia Internacional. International Monitoring Information. International Price Report of Fruits and Vegetables in Europe, February 2006.

In Colombia, small-scale (or smallholder) farmers are the primary agricultural producers, comprising 67% of Colombia's agricultural production (UNEP, 2005). The labor-intensive nature of specialty crops provides these small-scale producers with a comparative advantage in low cost and high quality production. Driven by expanding international markets and supported by public and private investment, small-scale farmers are working together to meet market demands for fresh fruit and vegetables (FFV's). Small-scale growers are forming farmer groups to pool resources, provide economies of scale, and collaborate to meet market requirements. Together, with multi-sector support for education, training, and investment, they are adopting improved agricultural production practices to attract and maintain buyers for consistent year-round supply. Smallholder agriculture economies, "*economias campesinas,*" are a critical area of development within the country as evidenced by several national programs and multi-institutional partnerships to improve the capacity of small-scale farmer production and export (Cannock, et al. 2006, Universidad Nacional de Colombia 2007). International partners investing in Colombia's rural sector include the United States Agency for International Development (USAID), via the Alternative Development Program (ADP). The ADP works in special regions to help reduce and replace the production of illicit crops, and assist farmers in producing and marketing high value horticultural crops. Colombia's ecological diversity - with regional variations in soils, climate and biodiversity - provides advantages in a broad range of agricultural activities. Some examples of these advantages are: perennial crops such as coffee, oil palm, forest species, flowers, fruits, and vegetables characterized by their high density value and intensive use of labor (Caballero, et al. n.d.). Development programs are working with farmers to replace illicit crops with some of these high value products.

Furthermore, programs launched by the Ministry of Agricultural and Rural Development, such as '*Apoyo Alianzas Productivas,*' (AAP) (or, Productive Support Partnerships), are active in eighty eight percent of the country's departments (28 out of 32 departments) to strengthen small-scale farmers' capacities (Barrantes 2007). The objective of these programs is to build partnerships between organized small farmers and the private sector, with the support of different facilitators (public entities, NGOs, other members of the production chain) (Barrantes 2007; Universidad Nacional de Colombia 2007). An AAP program in Boyacá's municipality of Ventaquemada provided technical and financial support to improve the product quality and increase the production of what is now one of the most successful small-scale cape gooseberry producers' group in the country, la Asociación de Productores de Ventaquemada (PROCAVEN). Through program support, PROCAVEN is a cape gooseberry farmer group with 47 members targeting export markets (Eurofresh Distribution, 2009, Universidad Nacional de Colombia, 2007). PROCAVEN also received technical support and training from local groups such as the Gobernación de Boyacá and the Servicio Nacional de Aprendizaje (SENA), the national training service. A primary strategy of the partnership programs is to improve product quality and production through the implementation of improved practices among small-scale farmers in Boyacá, and other regions of the country.

This review focuses on the cape gooseberry production practices of small-scale farmers in Boyacá. Increasingly globalized food supply chains and a growing market for nontraditional agricultural exports provide Colombia with a unique opportunity to capitalize upon its exotic fruit crops (Hallman et al., 2004). Colombia's year-round production capability and significant small-scale farmer base provide opportunities for stimulating the rural economy through the production and export of specialty crops.

Overview of Cape Gooseberry Production in Colombia

Crop description

Cape gooseberry**,** *Physalis peruviana*, is a tropical highland crop originating in Peru. It belongs to the Solanaceae family, and the genus *Physalis* includes about 100 species that form their fruits in an inflated calyx (Legge 1974, Salazar, Chaves-Cordoba and Jones 2006). The fruit is orange in color, with diameters and weights ranging between 3 – 6 centimeters (cm) and 4 – 5 grams respectively. The larger fruit sizes are selected for export and the smaller are typically found in domestic markets in Colombia (Agrocadenas, 2004). It is a semi-perennial herbaceous plant, sustaining production between 12 – 24 months, although commonly grown for 18 months in Colombia. The fruit is consumed both fresh and in processed forms (jams). Cape gooseberry is often packaged and shipped for export markets with the calyx, as it protects and preserves the fruit during transport. In the domestic market, the fruit is commonly sold without the calyx. The nutritional content of cape gooseberry is one of the attractive aspects for the fruit in international markets (Table 5). It is an excellent source of vitamins A and C, iron and phosphorus (Casas Vasquez, 2006), and contains a juicy pulp that is sweet and has a mild acid tang (Jaeger, 2001). The decoratively encased fruit is sometimes also purchased for special holiday celebrations.

Table 5 - Nutritional Content of Physalis peruviana, per 100 g of pulp

Component	**Content**
Calories	54.0 g
Water	90.0 g
Protein	1.5 g
Fat	0.5g
Carbohydrates	11.0 g
Fiber	0.4 g
Cinder	0.7 g
Calcium	9.0 mg
Phosphorus	2.1 mg
Iron	1.7 mg
Vitamin A	1730.0 UI
Thiamine	0.01mg
Riboflavin	0.17 mg
Niacin	0.80 mg
Ascorbic Acid	20.0 mg

Sources: Fischer, 2000, Almanzaand Espinosa, 1995

Primary Production Regions

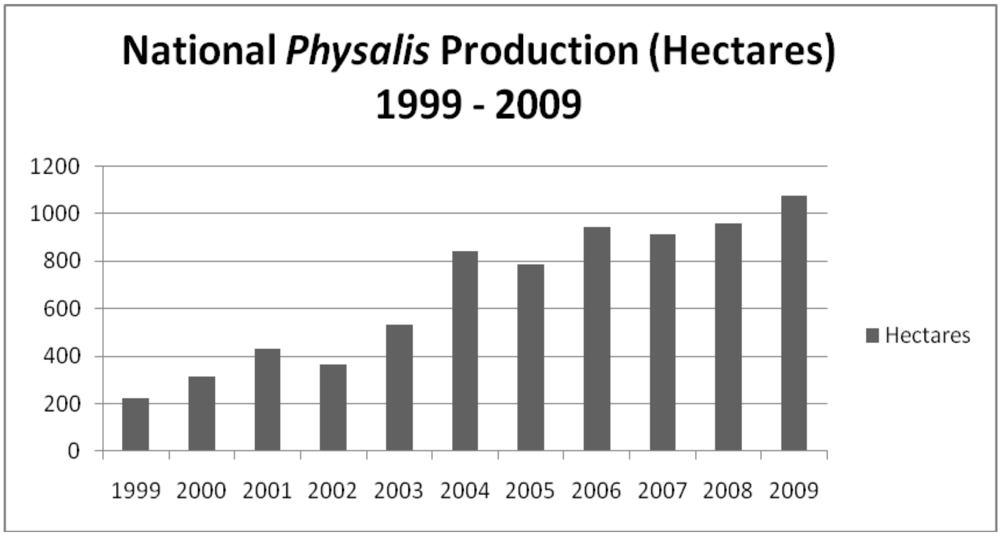
Over the past ten years there has been a steady increase in production of cape gooseberry (Agronet, 2011). As of 2009, the principal production areas were in the departments of Boyacá, Cundinamarca, and Antioquia (Table 6), with Boyacá being the largest cape gooseberry producing region in the country. Cundinamarca was formerly the largest producing department, but it experienced a decrease in production over the past few years due to widespread problems with *Fusarium spp.* The decline was evident by the national drop in production hectares during 2006 – 2007 (Figure 2), however Boyacá and Antioquia's production continue to increase, which contributes to the overall increase in national production in recent years.

Table 6 – Principal Cape Gooseberry Production by Department, 2009

Department	**Production (Tons)**
Boyacá	8,454
Cundinamarca	7,888
Antioquia	2,850
Nariño	143
Norte de Santander	75
Cauca	74
Total	**19,484**

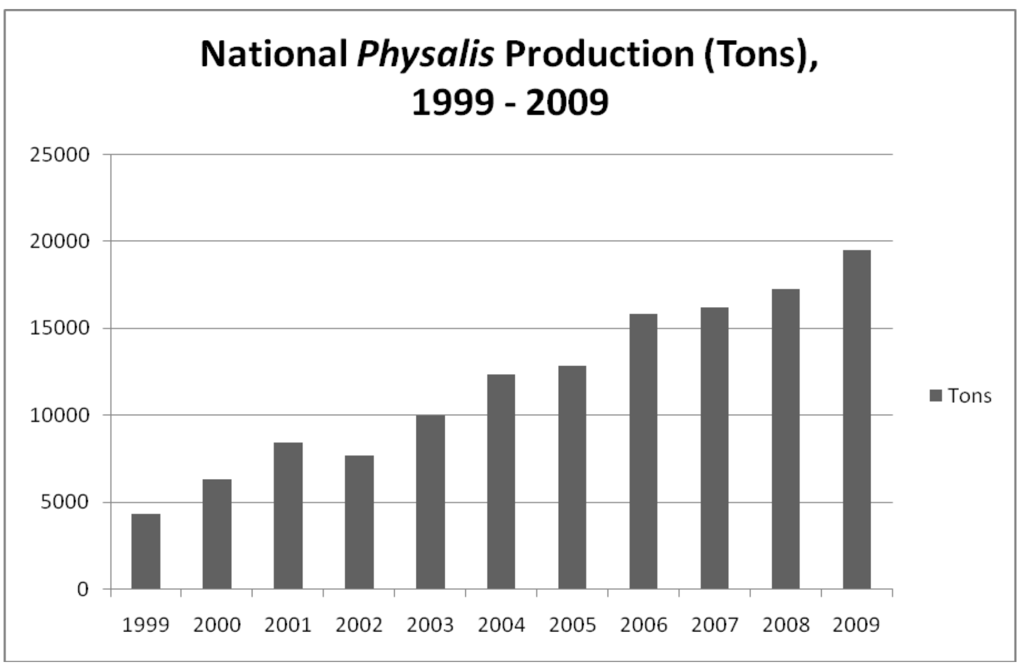
Source: www.agronet.gov.co

Figure 2 – Cape Gooseberry National Production in Colombia, by Area, 1999-2009



SOURCE: www.agronet.gov.co, 01/2011

Figure 3 – Cape Gooseberry Production in Colombia, 1999-2009



SOURCE: www.agronet.gov.co, 01/2011

Colombian cape gooseberry is produced primarily for export markets, where prices are considerably higher than those of the domestic market (an average of 1800 pesos/kg for export, compared to 800 pesos/kg on domestic markets). As mentioned previously, Colombia's primary competitors are Zimbabwe, Kenya and South Africa (Lopez, 2000; Pineiro and Diaz Rios, 2007). However, Colombia's product competes in terms of quality and their ability to provide continuous supply, which allows the country to experience a preferential price on world markets (Pineiro and Diaz Rios, 2007), whereas African countries compete in terms of price due to the countries' lower frieght costs (Pineiro and Diaz Rios 2007). Recent analysis of the 2009 production and export of cape gooseberry in the Department of Boyacá reveal that 75% of production was dedicated to export, while just 20% was dedicated to domestic sales (Table 7).

Table 7 – 2009 Cape gooseberry production summary, Department of Boyacá,Colombia

2009 Analysis – Boyacá Cape Gooseberry Production	
Planting area	204 hectares
Number of plants planted	408,000
Yield/hectare	25 tons
Production total	5100 tons
Export market (75%)	3825 tons
Domestic market (20%)	1020 tons
Losses (5%)	255 tons

Source: Oscar Leonel Gonzalez Henriquez, Gobernación de Boyacá, 2009

Description of Primary Cape Gooseberry Production Area

The Department of Boyacá is located in the Andean Region of Central Colombia, and covers an area of approximately 23,189 square kilometers. Boyacá's economy is mainly based on agriculture and livestock production, mineral exploitation, the steel industry, commerce and tourism. Agriculture is a major industry in Boyacá, where the climate, soils and altitudes provide favorable conditions for a multitude of crops. Most of the soils are fertile and rich in organic matter (Bertin, 2008). The region is largely composed of small scale agriculture and an average farm size of 1 hectare.

Agriculture has been developed and modernized in recent years, and the main crops are potatoes (*Solanum tuberosum),* corn (*Zea mays)*, onion (*Allium cepa)*, wheat (*Triticum aestivum L*.), barley (*Hordeum vulgare)*, panela (a food product made from the juice of sugar cane (*Saccharum officinarum* L), cassava (*Manihot esculenta)*, and milk production was also an important market commodity. In 2008 there were 4,737 hectares of fruit production cultivated by 5,248 farmers (Bertin, 2008). The principal fruit crops in the region are: 1) Andean fruits – curuba (*Passiflora mollissima)*, lulo (*Solanum quitoense)* , pitahaya (*Hylocereus trigonus)*, tree tomato (*Cyphomandra betacea sendth)*, passion fruit (*Passiflora edulis)*, papayuela (*Carica goudotiana)*, black berry (*Rubus glaucus Benth)*, cape gooseberry and 2) temperate zone fruits – apple (*Pyrus communis* L.), pear (*Pyrus communis* L.) plum (*Prunus domestica)*, guava (*Psidium guajava*), peach (*Prunus persica*), custard apple (*Annona reticulata*) and avocado (*Persea americana*) (Bertin, 2008). Many cape gooseberry farms are between 1 to 3 hours drive from Tunja, the department’s capital city. Tunja is approximately 71 miles from the nation’s capital of Bogotá, where most cape gooseberry exporter centers are located.

Agroecological Characteristics

According to Fischer (2000), cape gooseberry is easily adapted to a wide range of agroecological conditions. In Colombia, it grows between 1,500 and 3,000 meters above sea level, but the best crops are produced at an altitude between 1800 and 2800 meters above sea level, with average temperatures ranging between 55 and 64°F (Fischer 2000; Zapata et al., 2002) . Optimal rainfall for cape gooseberry is between 1,000 and 2,000 mm per year, and it requires an average relative humidity of 70 to 80%. Rainfall within Boyaca ranges between 1,500 – 2,500 mm per year, and the average temperature is 57°F. Overall, Boyacá's topography and climates are well suited for the optimal growing conditions of cape gooseberry. The department has different climates, from the very hot climate in the low region of Puerto Boyacá to the very cold temperatures in the high altitudes and snow-capped mountains Nevado de Güican and Sierra Nevada del Cocuy. Boyacá's climate allows for year-round production and its proximity to export centers and local markets in the nation's capital provide considerable opportunity for sales.

Cape Gooseberry Production in Boyacá

Small-Scale Producers

In Boyacá, cape gooseberry is grown primarily on hillsides by farms that range from on 0.25 – 10 hectares of land. As cape gooseberry continues to gain international market demand, small scale farmers in Colombia are joining together to form producer groups which allow them to pool resources and create economies of scale for export markets. In Boyacá, in 2009 there were 15 cape gooseberry producer groups, representing 349 farmers and 204 hectares (Gonzalez Henriquez 2009).

Soil Preparation

The land preparation is done primarily by extensive manual labor. Farmers often rent machinery for tillage while under traditional cultivation systems minimum tillage is carried out, and only the planting site is prepared (Pineiro and Diaz Rios 2007). The fields are cleared and cleaned of debris using manual tools, such as scythes and machetes. Soil tests are performed two to three months prior to planting. Cape gooseberry requires well drained soil with a pH between 5.5 and 7.0. Soil amendments are added according to soil analysis results. Farmers typically add 300- 500 grams of dolomitic limestone to each transplant site at the time of planting, to attain optimal pH levels. Farmers add two to four kg of organic matter (usually chicken manure), and 100 g of phosphorus to the transplant sites prior to planting. One month after planting, 80 to 120 g of a complete fertilizer (such as 10-30-10 of nitrogen, phosphorus and potassum respectively) is added to each plant.

Planting

Farmers purchase cape gooseberry seedlings (two months old) from certified nurseries. During the land preparation phase, small mounds of soil are prepared for each transplant, which is set manually. Planting distances are determined by land topography. Fields located on steeper slopes generally have larger planting distances between rows and spaces, to allow greater aeration and to facilitate ease of labor in production and harvest. In general, the recommended distances for sowing are 3x3 or 2x3 meters between plants and rows.

Trellising Sytems

A trellis system is established to help maintain the desired plant archetecture. The most common trellis systems are the “V system” and the “T system.” The stakes are installed such that the wiring and support of the plants are in the shape of a ‘V’ or ‘T.’ The trellising is an important aspect of cape gooseberry production, as it is the primary support for the plant (which can grow up to five feet tall or more) throughout the production cycle. The trellising system contributes toward the productivity and quality of the fruit crop, facilitating in pruning, disease management, and harvesting activities. The more common ‘V system’ increases light penetration into the canopy and crop aeration, to reduce development of disease (Figure 4).

Figure 4 – Trellising in ‘V system’ for Cape Gooseberry Crop in Boyacá, Colombia

Crop Management

As mentioned previously, crop fertilization plans are implemented according to the results of the soil analysis, which vary according to location. One month after planting, 80 to 120 g/plant of a complete fertilizer (NPK) is added, and an additional application of the same fertilizer is done two months later, at 150 to 200 g/plant, as well as 50 g of minor elements (Zapata et al. 2002). The application of minor elements is repeated every five months. When in full production, the physiological activity of the plant requires fertilization every two months. Complete fertilizers are applied (10-30-10, representing amounts of nitrogen (N), phosphate (P_2O_5) and potash (K_2O)) at 200 to 250 grams per plant (Zapata et al. 2002). During dry periods, farmers water plants manually, transporting water by buckets or hoses. Most small scale farmers do not have irrigation systems.

Weeds

Some of the most prominent weeds in the production are kikuyu grass *Pennisetum clandestinum* and ryegrass *Lolium perenne* L. Weeds are controlled primarily by use of machetes, scythes, and other non-mechanized tools, as well as by mulches. In some cases, farmers use herbicides, with the active ingredient glyphosate (Zapata P., et al. 2002).

Pruning

Pruning is an essential aspect of production management, requiring labor throughout the production cycle. Pruning is done primarily for plant archetecture formation and disease management. In the "V system" of trellising, pruning of the two basal branches is done to define the growth and development of the plant. As a result, tertiary branches developed, forming the desired plant architecture**.** This type of 'formation pruning' is done approximately three times in six months. Plants are often pruned to outward growing buds and branches, for ease of crop management and harvesting. Pruning is also done to eliminate unproductive or diseased/pest-infected branches.

Disease and Pest Management

The most critical problems in the production stage are the diseases caused by fungal or bacterial attacks, symptoms which are located mainly in the leaf area of the plant. Disease monitoring is conducted approximately every 20 days. Disease-affected material is removed and discarded away from planting sites. Some of the common diseases and their respective methods of control are: damping off (*Phythium sp*.), controlled primarily by good seed management practices at certified nurseries; gray spot (*Cercospora sp.*), managed primarily in cultivation practices such as planting distances, proper trellising management to allow sufficient ventilation, regular pruning for sanitation, collection and destruction of diseased fruit, and weed management; *Phoma sp*, managed by similar practices for gray spot; white mold (*Sclerotinia sclerotiorum*), managed also by using appropriate planting distances to maintain good aeration, the removal and destruction of infected plant material, as well as one or two applications of fungicides such as Benomyl, chlorothalonil, Carbendazim, iprodione or mancozeb (Zapata P., et al. 2002).

Additional diseases are: black leaf spot (*Alternaria sp.)*, managed by the selection of resistant cultivars, and the management of other diseases are reported to have a direct effect on the incidence and spread of the disease (Blanco 2000, Zapata P., et al. 2002).   Recommended fungicides to combat the disease are based on the following active ingredients: chlorothalonil, mancozeb, cupric hydroxide, iron and copper salts. Gray mold (*Botrytis sp.)*, another common disease in cape gooseberry production, currently does not have well-defined disease management strategies among small scale farmers in Boyacá, however farmers tend to implement the same management practices used in other tree crops diseases that develop under the same conditions The following fungicide ingredients are recommended, as they are successful for the control of *Botrytis* in other fruit crops: chlorothalonil, carbenzazim, benomyl and prochloraz (Zapata P., et al. 2002).

While pest problems varied according to location, the most common pests in *Physalis* production are white flies (*Trialeurodes vaporariorum*), cutworms (*Agrotis sp*.), flea beetles (*Epitrix sp*.), slugs (*Milax sp*.), and leafminers (*Liriomyza sp*.). White flies are the most important pest, presenting a considerable challenge for export requirements when found among harvested fruit. Pest control strategies varied according to farmer experienceand technical assistance, and include fumigation sprays, entomopathogenic species *(Verticillum lecanni, Bacillus thurigiensis*), and pruning management (Ariza O. 2000 and Zapata et al. 2002).

Farmers often utilize the services of professional agronomists in their pest and disease management. Exporters provided technical assistance in the form of monthly agronomist consultations for the farmers. Technical assistance in production management is also available among several government and civil society entities, such as programs launched through the Ministry of Agriculture and Rural Development and the Gobernación de Boyacá (the state government). Some of the available technical assistance programs are Agromárquez, Crecer and SENA (the national vocational training institution). Farmers also utilized trainings or resources developed by or in partnership with the Asociación Hortifrutícola de Colombia (ASOHOFRUCOL), the national horticulture association.

Harvest

Harvest commences six to eight months after the initial planting, and generally continues for an additional ten to twelve months. The cape gooseberry plant produces its best and largest fruits during the first months of harvest, however with good crop management, high quality fruit can be produced throughout the year. Cape gooseberry is a climacteric fruit that continues its ripening process once picked. For this reason precision in coordinaton of harvest and collection/shipping among farmer group members and the exporters is of great importance. Harvesting is done once every week, by manual cuttings of fruit which meet the appropriate levels of maturity (in size and color). Harvesting is done by using scissors, and fruit is collected in dedicated (used only for cape gooseberry production) plastic containers that are usually purchased from exporters. In some cases the scissors are immersed in a water and iodine solution before moving to the next plant. Harvesting is done carefully, to avoid breaking or damaging branches or stems. Harvest workers are are well experienced in selecting fruits of the highest quality, according to export market standards (large fruits, 2.5 to 4 cm diameter, free of pests and disease, and presenting a orange/yellow color). It could be said that the first 'pre-selection' process is done in the field, among harvesters, followed by grading processes at farmer drop-off centers and/or the exporter packing and distribution centers. Farmers try to provide the required handwashing and restroom facilities for farm workers, in an effort to promote and practice safe and sanitary conditions during the harvesting process. The extensive labor required for harvest is typically the highest budgetary expense in cape gooseberry production.

Post-harvest

Farmer groups coordinate their harvesting schedules together to meet market demands. Upon harvesting, the farmers drop off their crops at the group's designated collection center, where their product is weighed and coded (for traceability, by use of handwritten registers and coding slips for each plastic bin). Registers are kept by a group administrator, recording dates, quantities (number of containers) and codes for the farmers' product, often by hand. The product is then picked up by the exporter truck within eight hours of harvest, and shipped (non-refrigerated) to Bogotá. There are essentially no technological post-harvest treatments or processes by the farmers, other than the safe and sanitary selection and handling of quality fruits, and temporary storage in clean holding facilities. However, in some cases exporters have opened grading and selection centers in nearby towns, which are staffed by 15 to 20 people who conduct careful pre-grading and selection processes. In this case, the farmers' products are weighed and recorded after the selection process. Those fruits that do not meet export market requirements (i.e., size, color, uniformity, etc.) by this selection process are discarded and/or retained for the domestic market.

Advances in Boyacá's Cape Goooseberry Production

The cape gooseberry production cycle by small-scale farmers in Colombia is commonly 18 months, although cycles may be longer depending upon crop management. Small-scale farmers are increasingly taking advantage of technical trainings offered by government programs, non-government organizations and (in some cases) the private sector, to improve their agronomic and disease and pest management practices. In Boyacá, there is a growing trend in participation of small-scale cape gooseberry producer groups in which farmers often share in farm labor, disease monitoring and inputs, as well as the expenses of technical trainings for improved production technologies. As Boyacá seeks to increase its cape gooseberry export and strengthen its competitiveness in international markets, the adoption of formal good agricultural practices (GAPs) protocols and food safety standards will increasingly be an important aspect of small-scale farmer production practices. Though production strategies have improved in recent years, there remains a need for advances in methods of disease and pest control, plant nutrition, and more sophisticated systems in fruit selection and product traceability processes.

CHAPTER 3

AN EVALUATION OF THE ADOPTION OF GOOD AGRICULTURAL PRACTICES BY SMALL-SCALE CAPE GOOSEBERRY (PHYSALIS PERUVIANA) FARMERS IN BOYACÁ, COLOMBIA

Introduction

As Colombia continues to promote and expand its export of high-value horticultural crops and invest in the economic growth of its rural sector, national efforts are underway to improve production practices and meet international food safety requirements. One of the major goals of *Visión 2019* (a plan written by the Colombian Department of National Planning, which drives the nation's primary goals and objectives for advancement) is to increase the percentage of exports, imports and investments (PROEXPORT). To that end, strategic efforts are in place to improve the technical and export capacities of its rural sector, and increase international market-oriented production (Mejia, 2005; Sanabria, 2005). National efforts such as those of the Colombian Export Promotion Agency (PROEXPORT) have experienced success in promoting and improving the quality of some of the country's high-value, exotic fruit crops. One Colombian specialty crop which has gained considerable success in European export markets is *Physalis peruviana*. Locally, the fruit is known as 'uchuva,' and internationally (in English-speaking countries) it is known as cape gooseberry. Cape gooseberry is among the top priority fruits of the government's Horticultural and Fruit Export Plan *('Plan Exportador Hortifrutícola')*, which aims to increase the fruit export each year over the next 10 years (Bayer CropScience 2006). It is the second largest export fruit from Colombia, after bananas and holds economic importance among small-scale producers in the country.

In Colombia, a strategic initiative to improve product quality and export revenues is the implementation of good agricultural practices (GAPs) and food safety standards among all producers (including small-scale) of fresh fruits and vegetables (FFVs). As sanitary and phytosanitary (SPS) requirements continue to take on an increasingly important role in the governance of global agricultural food chains, compliance with food safety and quality standards has become essential to market access and competitiveness (Bain, 2010; Jaffee & Henson, 2004). Of interest is GlobalGAP, the internationally recognized standard developed by European retailers to ensure safe production, environmental protection, worker welfare and sanitary handling of fresh food commodities throughout the supply chain. Though it is a private voluntary standard (PVS), it is often required by European retailers and holds a key to accessing international markets for fresh agricultural commodities. Additionally, Colombian exporters have developed GAP protocols which are largely based upon the GlobalGAP standard, and serve (in some cases) as a precursor to future adoption of the official standard. Through multi-sector partnerships, many programs have been established in Colombia to provide the technical assistance, support and investment in small-scale agriculture to meet the demands and requirements of the international market.

In many cases, small-scale farmers form farmer groups to adopt the GlobalGAP standard under the Group Certification Option. By pursuing and obtaining group certification, they can significantly reduce external certification costs, such as inspection and overhead expenses (GlobalGAP 2011). Through coordinated efforts among the farmer groups, the members are also able to share labor, inputs, pest and disease monitoring, product transport and technical knowledge, all of which make the group certification an attractive and potentially viable option for small scale producers. The benefits notwithstanding, the rigorous nature of the GlobalGAP standard and its basic requirements, such as detailed documentation, infrastructure needs, access to capital and technology, often present formidable challenges for producers in developing nations. Small-scale growers also form farmer groups to build economies of scale and work with specific exporters to meet their GAP protocols. Exporter GAP protocols require similar resources; however exporters provide some technical assistance to help farmers in the GAP adoption process. Still, other farmers have not yet committed to any formal GAP protocol, and may adopt minimal to no GAP or food safety practices.

This study explored the strategies used by small-scale cape gooseberry producers (cultivating on 2 ha or less land) to meet international food safety standards and access global markets. In a milieu of strict international food safety requirements, national and regional government economic development goals are juxtaposed with the realities of resource-limited smallholder agriculture. This research examined farmer experiences and strategies to transition from traditional cultivation to more complex production protocols that meet international food safety goals. The objectives of this study were to: i) identify some of the key characteristics for the successful adoption of good agricultural practices (GAPs) and food safety standards among small-scale cape gooseberry producers in the Márquez region of Boyacá, Colombia; ii) evaluate the impacts of GAPs and food safety standards upon farm production, product quality and famers' access to markets and iii) evaluate the economic impact, if any, of adoption of GAP and food safety standards on these small-scale farmers.

Study Hypotheses

<u>Hypothesis 1:</u> The adoption of good agricultural practices (GAPs) and food safety standards has beneficial impacts on overall small-scale farm production, crop quality and farmer capacity.

Hypothesis 2: The adoption of good agricultural practices and food safety standards provides economic gains through improved farm productivity.

Description of Study Area

Boyacá, a Colombian *'departamento'* (or department, similar to state), is located in the Andean Region of Central Colombia and covers an area of approximately 23,189 km^2. Agriculture is a major industry in Boyacá, where the climate, soils and altitude provide favorable conditions for a multitude of crops. Year-round agricultural production is facilitated by high temperatures in the lower elevations of Puerto Boyacá to the cooler temperatures in the high altitudes. The proximity to export centers and local markets in the nation's capitol of Bogotá provide considerable opportunity for sales. The most prominent crops include potatoes and beans, but Boyacá is also known for fruit production. The region is largely composed of small-scale agriculture, in which farmers cultivate an average of 1 ha on remote hillsides with limited rural infrastructure (Bertin 2008).

Research Methodology and Data Sources

A survey was distributed among small-scale cape gooseberry farmers producing on 2 ha or less of land, in the Centro and Márquez provinces of Boyacá, the country's leading cape gooseberry producing region. During the study period, July to December 2009, the surveyed farmers were following three types of GAPs production: 1) exporter GAP protocols (the EGAP group); 2) GlobalGAP certified (the GGAP group); and 3) non-GAP certified farmers (the NOGG group) who did not follow a formal GAP protocol and adopted minimal to no GAP practices. Surveys were distributed to over 70 small scale farmers in the region, and 27 completed surveys were analysed, consisting of 14 respondents in the EGAP group, 7 in the GGAP group and 6 in the NOGG group.

Surveys were distributed at farmer group meetings, followed by repeated semi-structured interviews with individual farmers, farmer groups, and farm visits. The survey addressed issues of GAP training and farm documentation, horticultural production practices, changes made toward adoption of good agricultural practices and food safety practices, identification of production problems, and the impacts of adoption of GAP and food safety practices on farm production, market experience (buyers, prices, etc.) and farmer capacity (see Appendices 10 and 11 for the English and Spanish surveys used). Demographic data included respondent and farm characteristics.

The survey posed questions to understand the changes that farmers were making towards the adoption of GAP and food safety practices and the relative impacts. Farmers were asked to describe the GAP and/or food safety changes made in their farm production and management within the previous two years, 2007-2009 as well as the impacts (increases or decreases) in areas of farmer and farm worker techinical capacities, farm productivity, cape gooseberry fruit quality and market performance. Additionally, similar to a method used by Bertuglia and Calattrava-Requena (2006), an aggregated index of adoption (GAP Index) was calculated based upon survey responses. The differences in the GAP Index among the farmer GAP groups (EGAP, GGAP and NOGG) was used to identify significant differences in the adoption levels of GAP and food safety practices among the groups.

Key GAP & food safety practices considered in this study and used for the GAP index were:

1. Irrigation water source	8. Compost application
2. Irrigation water management	9. Pesticided application practice
3. Quantity of irrigation	10. On-farm fruit transport
4. Water analysis	11. Farm worker GAP training
5. Quantity of fertilizer used	12. Worker hand-washing facility
6. Type of fertilizers used	13. Worker restroom facility
7. Manure application	14. Traceability system

From these practices the aggregated index of adoption was defined as follows:

$$I = \frac{1}{14} \sum_{i=0}^{i=14} \alpha_i$$

where $\alpha_i = 1$ if the practice i is realized and $\alpha_i = 0$ if it is not. Descriptive statistics, analysis of variance (ANOVA), and Tukey Honestly Significant Difference (HSD) post hoc tests were performed to analyze the data and identify significant differences among the farmer groups.

Given that the total number of registered cape gooseberry producers in the department of Boyacá at the time of the study was 349, the sample size of the study represents approximately 8% of the total producers (Gonzalez Henriquez 2009). While the small sample size limits gross generalizations, several distinctions may be clearly observed. It is also important to note that additional essential aspects of the research process were the efforts to relationally connect with farmers, technical assistance experts, and other community members who were involved in cape gooseberry production and export in the region. Many informal experiences such as shared meals, home visits, helping with truck-loading, and conversations at local coffee shops provided opportunities for establishing rapport, building relationships, and gaining a deeper understanding of the cultural and socio-economic context of smallholder farming in remote Andean communities. While the farmer survey provided the basis for empirical analysis, these informal experiences were invaluable to establishing collegial bonds, learning about local norms and values, and about the farmers' decision-making processes.

To evaluate the costs of adoption of GAP practices, a partial budget analysis for GAP and non-GAP certification was performed. Farmer production costs records were collected from some survey respondents, while others were provided by secondary data. Secondary data on cape gooseberry production costs were obtained from the Gobernación de Boyacá (the Boyacá state government) and from Agromárquez, a government agricultural technical assistance program. Agromárquez focuses on farmer capacity building and the implementation of GAPs and the GlobalGAP certification among small scale horticultural producers in the region. The farmers within the NOGG (non-GAP certified) group did not provide production costs records, due to very limited recordkeeping. Therefore, production costs for the NOGG farmers were obtained from a similar study conducted by Pineiro and Diaz Rios (2007), which described expenses for traditional (non-GAP) gooseberry production for small-scale farmers in the neighboring Department of Cundinamarca. Cundinamarca's costs of production are similar to those of Boyacá, and for the purpose of this study, the costs from the Pineiro and Diaz Rios (2007) study were adjusted for inflation to 2009.

An estimated cash flow statement was also produced. The estimated earnings for one hectare of cape gooseberry for a standard eighteen month production cycle were provided by the Boyacá State Government's Ministry of Agriculture. Interviews with representatives from the cape gooseberry export market (exporter managers, government export market monitors, and GlobalGAP coordinators) indicated that cape gooseberry prices and earnings are typically lower for non-GAP adopters. Therefore, the earnings for non-GAP production, that is, the NOGG production, were estimated at two-thirds of the average earnings provided by the Boyaca State Government.

Results

Small-scale cape gooseberry production and GAP adoption

i. Farmer Demographics

No significant differences were detected with respect to the general demographics of the farmers surveyed. Of the 27 respondents, 63% were male and 37% were female (Table 8). Most respondents were within the age range of 31 -50 (67%), while the average life expectancy for the total Colombian population was 73 years of age in 2009 (UNICEF 2011). Most of the respondents had education levels which fell between eighth grade or less (59% of respondents). The farms averaged about one hectare (Table 9). The average household size (number of household members) was four. The average years producing cape gooseberry among survey respondents was three years. Most respondents did not have diversified farms and produced only one or two crops. The respondents had an average of three family members employed for their cape gooseberry production labor. The average number of paid farm workers was 12. Additionally, the farm altitudes fell within the optimal range for cape gooseberry production, which is between 1800 and 2800 meters above sea level (Fischer 2000).

Table 8 – Respondent Demographics - Gender, Age Group & Education Levels

Gender	Survey Percentage
- Male	63%
- Female	37%
Age groups	
- < 25	7%
- 25 – 30	11%
- 31 – 40	37%
- 41 – 50	30%
- > 50	15%
Education Levels	
- 4th grade or less	37%
- 8th grade or less	22%
- 1-3 years of secondary school	15%
- Completed secondary school	15%
- University graduate or other education	11%

Table 9 - Respondent Farm Characteristics, Márquez Province, Boyacá, 2009

	Exporter GAP		GlobalGAP Certified		Non-GAP Certified	
	Mean	SE	Mean	SE	Mean	SE
Hectares	1.07	0.14	0.79	0.10	1.08	0.20
Household size (members)	4.0	0.44	3.0	0.29	4.0	0.60
Years producing Cape gooseberry	2.5	0.35	3.31	0.58	2.67	0.33
No. of other crops	1.0	0.25	1.43	0.20	0.50	0.22
No. of paid family labor	4.0	0.19	3.0	0.90	3.0	0.54
Total number farm workers	16.0	2.4	10.0	1.60	8.0	1.4

ii. GAP Training and Farm Documentation

Farmers following exporter GAP protocols attended more GAP trainings (38) and reported more GAP training hours per year, compared to the GlobalGAP (6) and NOGG (14) groups ($p<0.001$) (Table 10). Though the mean hours for the NOGG group were higher than the GGAP group, the range of hours reported among the NOGG group was 0 – 240 hours per year. It is important to note that the number of required training hours is related to the farmer's level of development. Most of the GGAP respondents had already attended trainings prior to the survey period and improved their technical capacities. The respondents reported an average of 2.3 hours per week for GAP and/or food safety documentation, although during the survey interviews most farmers emphasized the difficulty of adjusting to extensive documentation. It was not clear what information was being documented by members of the NOGG group. Similar practices between the GGAP and EGAP groups were reported, with respect to the following variables: training all farmer workers in GAP protocols, the presence of a traceability system, and keeping production costs and cape gooseberry income records. This indicated that these four characteristics were likely strong components in the adoption of GAP and food safety protocols. Some of these practices were also adopted by some farmers in to the NOGG group.

Table 10 - Respondents' GAP Training and Farm Documentation, Márquez Province, Boyacá, 2009

	Response	Exporter GAP	GlobalGAP Certified	Non-GAP Certified
		Mean[z]	**Mean**	**Mean**
Attend GAP Trainings	Num./ year	38 a	6 b	14 b
Training hours	Hours/ year	240 a	51 b	84 b
Documentation	Hours/ week	3	1	2
		Percent[z]	**Percent**	**Percent**
All workers GAP trained	Yes or No	86	100	50
Traceability methods change	Yes or No	100 a	100 a	17 b
Production costs records	Yes or No	100	100	83
Cape gooseberry income records	Yes or No	93	100	83

[z]Means and percentages in the same row followed by the different letters are significant at $p<0.05$, using the Tukey HSD Comparison Test. All other factors showed no significant difference among groups.

iii. Production Practices

Respondents reported similar production practices related to disease monitoring, pruning intervals, and the duration of their cape gooseberry production. Disease monitoring was conducted at 17 to 21 day intervals, pruning was done every two to three weeks, and the production duration was an average of 20 months for all three farmer groups. The respondents' reported yields were significantly higher for the GGAP group ($p<0.05$), with an average of 18 kg/plant, compared to 12 kg/plant for the EGAP group and 9 kg/plant for the NOGG group (Table 11). Although most farmers did not have irrigation systems, some farmers irrigated their crops manually by transporting water in buckets during dry periods. Water samples for these ‘irrigation’sources were sometimes submitted to local laboratories for analysis, in order to test for bacterial contamination. Water analysis was conducted more often by the GGAP groupr (71% of respondents) ($p< 0.05$) compared to the other two groups (Table 11). All groups reported conducting soil analysis, and some use of paid professional agronomists. This included the paid services of monthly monitoring by exporter firm agronomists.

Table 11 – Respondents' Crop Yields and Production Practices

	Response	**Exporter GAP**	**GlobalGAP Certified**	**Non-GAP Certified**
Production practices		**Mean**[z]	**Mean**	**Mean**
Average yield	(kg/plant)	12.0 b	18.0 a	9.0 b
		%[z]	**%**	**%**
Water analyzed	Yes or No	7 b	71 a	0 b
Soil analyzed	Yes or No	100	100	100
Use of paid professional agronomist	Yes or No	64	29	33

[z]Means and percentages in the same row followed by the different letters are significant at $p<0.05$, using the Tukey HSD Comparison Test. All other factors showed no significant difference among groups.

iv. Adoption of GAPs & Food Safety Practices

Farmers indicated and briefly described the GAP and food safety practices which they had adopted within the last two years(2007-2009). Farmers following exporter GAP and GlobalGAP standards had adopted most of the improved agronomic practices and food safety protocols within the last two years, and significant differences were detected in ten practices, as well as in the GAP Index (the aggregated index of adoption) (Table 12). Tukey HSD comparisons showed that generally, the changes and/or adoption of these practices were more frequently reported among the EGAP and GGAP groups compared to the NOGG group. This is expected as the management of these variables relate very directly to the requirements of formal GAP certifications. The water source was changed by some farmers in all three groups, but these were not significantly different. Changes to irrigation water management were higher among the EGAP than the other groups. No irrigation water changes were reported by the NOGG group. Fertilizer amounts were also changed among the groups, but the differences were not signficant. More EGAP farmers changed their fertilizer types than the other groups. Manure application, compost application and pesticide use practices were also signficantly different among the groups. On-farm fruit collection was changed by most EGAP farmers, followed by NOGG and GGAP farmers. The change made in on-farm fruit collection was the use of regualrly cleaned plastic bins for harvest, collection and transport of cape gooseberry fruit (see Table 13 for description of changes made). GGAP farmers may have made changes to their operation in earlier years of GAP adoption. For several other GAP and food safety practices, including changes in farm worker training, hand-washing facilities installation, farm worker restroom installation and creation of a traceability system, responses were similar among the GAP adopters groups (EGAP and GGAP farmers) and much lower for the NOGG group. The aggregated GAP Index was similar among the EGAP farmers and GGAP groups, compared to the much lower 25% practice adoption for the NOGG group.

Table 12 – Respondents' Changes in GAP & Food Safety Practices, Márquez Province, Boyacá, 2009

	Exporter GAP		GlobalGAP Certified		Non-GAP Certified	
Responding 'Yes' to Changes made in GAP & Food Safety Practices	**Percent**[Z]		**Percent**		**Percent**	
Water source	29		14		17	
Irrigation water management	79	a	14	b	0	b
Fertilizer amount	71		43		33	
Fertilizer type	100	a	43	b	33	b
Manure application	71	a	0	b	33	ab
Compost application	79	a	29	ab	17	b
Pesticide application	93	a	86	a	17	b
On-farm fruit collection	86	a	29	b	33	ab
Farm worker training	93	a	100	a	33	b
Hand-washing facility installation	93	a	100	a	33	b
Worker restroom installation	86	a	100	a	33	b
Traceability system	100	a	100	a	17	b
GAP Index	76	a	59	a	25	b

[Z]Pecentages in the same row followed by the different letters are significant at $p<0.05$, using the Tukey HSD Comparison Test. All other factors showed no significant difference among groups.

According to survey responses, descriptions of the key changes that were made by the EGAP and GGAP groups are outlined in Table 13.

Table 13 – Description Changes in GAP & Food Safety Practices, Márquez Province, Boyacá, 2009

Type of change	**Description of change**
Change in fertilizer type:	Respondents reduced use of chemical fertilizers, used more organic fertilizers
Change in manure application:	Respondents switched to chicken manure
Change in compost application:	Respondents increased use of compost
Change in pesticide application:	Respondents used less chemicals, and only the approved chemicals (approved by exporter, and/or national regulatory agency); respondents adhere to maximum residue levels (MRLs)
Change in on-farm fruit transport:	Respondents use plastic containers purchased from exporter; containers are washed regularly and used only for cape gooseberry production.
Change in farm worker GAP training:	Most farm workers received training in GAP
Installation of hand-washing facility:	To promote clean and safe hygenic conditions, farmers following GAP protocols provide hand-washing facilities for farm workers, as well as signage to promote frequent hand-washing.
Installation of farm worker restroom:	Workers have access to clean restroom facilities.

v. Production Challenges

The GlobalGAP certified farmers reported minimal production challenges relative to the other groups (Table 14). Respondents among the EGAPand NOGG groups reported significant challenges for: the presence of weeds, fungus on the calyx, nutrient deficiences, small fruit size and non-uniform fruit. Though the EGAP group made important changes and/or adoption of GAP and food safety practices, they reported higher incidences of production challenges than the GGAP group. This may be reflective of their early stage in the GAP implementation process. While it was expected that the NOGG farmers would report higher incidences of production challenges, their intermediate scores may be due to limitations in the sample size.

Table 14 - Respondents' Horticultural Production Challenges, Márquez Province, Boyacá, 2009

	Response	**Exporter GAP**		**GlobalGAP Certified**		**Non-GAP Certified**	
Production issue		**Percent**[Z]		**Percent**		**Percent**	
Weed problem	Yes or No	100	a	29	b	83	a
Fruit cracks	Yes or No	79		57		83	
Fungus on fruit	Yes or No	79		29		67	
Fungus on calyx	Yes or No	93	a	29	b	67	ab
Insect damage	Yes or No	86		43		67	
Disease	Yes or No	93		57		50	
Nutrient deficiencies	Yes or No	79	a	14	b	33	ab
Deficient water	Yes or No	36		43		50	
Small fruit size	Yes or No	64	a	0	b	50	ab
Non-uniform fruit size	Yes or No	79	a	0	b	67	a
Non-uniform fruit color	Yes or No	36		0		17	

[Z]Pecentages in the same row followed by the different letters are significant at $p<0.05$, using the Tukey HSD Comparison Test. All other factors showed no significant difference among groups.

vi. Impacts of GAP & Food Safety Changes Over Past 2 Years

The EGAP and GGAP farmers reported mostly positive impacts on their farm, production, and market experiences as a result of adoption GAP and food safety practices (Table 15). All groups reported an increase in quality fruit per harvest, with the EGAP group reporting the highest amount (54% increase), followed by the GGAP group (16% increase) and the NOGG (14% increase). No change in selling price was reported for the EGAP and NOGG groups, while of GGAP respondents reported an average 7% increase in selling price. The only group that reported a change in the number of buyers was the GGAP group, with farmers reporting a 9% increase. While there was no reported effects on farm income, production costs were higher for the EGAP group, followed by the NOGG and the GGAP group. Thus, these EGAP farmers reported a decrease in savinags compared to the other groups. An increase in farmer GAP knowledge was reported by all groups, and significant difference was detected between the EGAP and NOGG groups. The farmers' perception of increases in GAP knowledge for their farm workers were 56% for EGAP, 51% for GGAP and 20% for NOGG. The EGAP reported a larger increase in volume of export quality fruit compared to the GGAP and the NOGG groups. Again, the NOGG group made sporadic changes in their GAP and food safety practice, as described in the *Changes in GAP and food safety practices* section above. It was unclear why the GGAP reported higher price variability (2.86% respondents) compared to the EGAP and NOGG groups. In general, the GAP certified groups reported higher mean values for positive impacts of GAP and food safety practices compared to the NOGG group.

Table 15 - Respondents' Reported Positive or Negative Impacts of GAP & Food Safety Practices, Negative values indicate negative impact of GAP practices on factor.

	Exporter GAP		GlobalGAP Certified		Non-GAP Certified	
Change	**Percent**[Z]		**Percent**		**Percent**	
Fruit quality	54	a	16	b	14	b
Selling price	0	b	7	a	0	b
No. of buyers	0	b	9	a	0	b
Income	4		8		0	
Production costs	60	a	12	b	20	b
Savings ability	-3		3		-2	
Farmer GAP knowledge	66	a	51	a	33	b
Worker GAP	56	a	51	a	20	b
Volume of export quality fruit	77	a	26	b	15	b
Price variability	0	b	3	a	0	ab

[Z]Pecentages in the same row followed by the different letters are significant at $p<0.05$, using the Tukey HSD Comparison Test. All other factors showed no significant difference among groups.

vii. Economic evaluation of GAP versus non-GAP adoption strategies

Small-scale farmers have to find ways to comply with GAP and food safety requirements in a manner that is cost-effective, otherwise they may face costly rejections in the market (Trienekens, and Zuurbier, 2007, Bayramoglu, Gundogmus, & Tatlidil, 2010, Sriboonchitta, Wiboonpongse, & Sriwichailamphan, *n.d.*). In Boyacá, most technical agricultural assistance programs and public-private partnerships were formed to train and assist small-scale producers in obtaining the GLOBALGAP (GGAP) group certification. Furthermore, interviews with exporter representatives revealed that in many cases exporter GAP protocols were modeled after the GGAP standard and were a step towards preparing farmers for the GGAP certification. Interviews with exporters, technical assistance program coordinators and government officials who were involved in the production and export of cape gooseberry emphasized the importance of the implementation of the GGAP standard as a means for improving small-scale farmer competitiveness in the region. Therefore, for the purpose of the economic evaluation, a comparison was made between the GGAP and NOGG group production costs and estimated earnings. A partial budget analysis was performed to evaluate the costs of the GGAP and non-GAP group production strategies, for an 18 month production period (Table 16). The listed GGAP budget costs are the average of ten production budgets of small-scale GGAP cape gooseberry farmers within the region. Only those costs associated with the adoption of GAP and food safety practices were considered in the partial budget analysis. As mentioned previously, due to the lack of production records by NOGG survey respondents, the non- GAP certified cape gooseberry production costs used for this analysis were obtained from a similar study conducted in neighboring Cundinamarca (Pineiro and Diaz Rios 2007), and the costs were adjusted for inflation to 2009.

The analysis showed that the highest costs for small scale cape gooseberry farmers were labor costs, consisting of 43% for GGAP farmers and 52% for non-GAP certified farmers (Table 16). The trellis system maintenance and harvesting required the greatest amount of labor. Secondly, the expenses for inputs absorbed 37% for the GGAP group and 28% for the non-GAP certified group. The greatest expense for inputs was chemical fertilizers. This may be related to the GAP requirement of using GAP-approved chemicals, which are less toxic and more expensive. Expenses incurred for production services (tillage machinery rental, and soil analysis) comprised 1% for GGAP and 0% for the non-GAP group. The subtotal for variable costs for the GGAP and non-GAP groups were 15,777,750 Colombian pesos (COP) ($7,889 USD) and 12,893,437 COP ($6,447 USD) respectively. Variable costs were 80% for the GGAP group and 81% for the non-GAP group. The fixed costs (administrative overhead, technical assistance, depreciation of tools and equipment, and construction and improvements) were 20% for GGAP farmers and 19% for non-GAP farmers. The estimated total GAP related cape gooseberry production costs for an 18 month production cycle as of May 2009 were 19,608,726 COP ($9,804 USD) for the GGAP group, compared to 15,994,598 COP ($7,997 USD) for traditional, non-GAP certified production.

Table 16 – Partial Budget for Small-Scale Cape Gooseberry Production under GlobalGAP and Non-GAP Certified Schemes in Boyacá, Colombia, 2009 for 18 Month Production Cycle (for 1 hectare)

	GlobalGAP		Non-GAP Certified*	
LABOR	**(Col pesos/ha)**	**%**	**(Col pesos/ha)**	**%**
Installation of stakes	759,500	4	627,156	4
Hanging & tieing	1,160,000	6	583,557	4
Health protection**	368,916	2	0	0
Pruning	523,500	3	513,128	3
Weed control	182,100	1	494,123	3
Fertilization	245,600	1	380,095	2
Harvesting	4,608,200	24	5,589,630	35
Pest & disease control	570,200	3	188,166	1
Subtotal for labor	**8,418,016**	**43**	**8,375,856**	**52**
INPUTS				
Soil amendments	174,500	1	192,036	1
Organic fertilizer	1,565,500	8	727,853	5
Chemical fertilizer	2,798,500	14	1,683,747	11
Plants (seedlings)	442,000	2	335,378	2
Fungicides	1,104,000	6	900,294	6
Insecticides	916,500	5	553,066	3
Herbicides	90,000	0.46	125,208	1
Oil and fuel	74,648	0.38	0	0
Subtotal for inputs	**7,165,648**	**37**	**4,517,581**	**28**
SERVICES				
Tillage machinery rental**	139,086	1	0	0
Soil analysis	55,000	0.28	0	0
Subtotal for services	**194,086**	**1**	**0**	**0**
SUBTOTAL OF VARIABLE COSTS	**15,777,750**	**80**	**12,893,437**	**81**
Fixed Costs				
Administrative overhead	1,200,856	6	818,244	5
Technical Assistance	56,400	0	0	0
Depreciation of tools & equipment**	2,073,720	11	2,282,917	14
Construction & improvements**	500,000	3	0	0
Subtotal of fixed costs	**3,830,976**	**20**	**3,101,160**	**19**
TOTAL PRODUCTION COSTS	**19,608,726**		**15,994,598**	

Note: 1 USD = 2000 Colombian Pesos, *The listed costs for Non-GAP certified farmers are taken from a 2007 FAO study of cape gooseberry farmers in the neighboring department of Cundinamarca, where costs are relatively similar to Boyaca; the listed costs have been adjusted for inflation to 2009. **Both GAP and Non-GAP costs obtained from 2007 FAO study and non-depreciated costs were adjusted for inflation to 2009.

Notes contined: for the purposes of the study, a useful life of more than one harvest was estimated for poles, stakes and wire used in props, so that the cost was spread over two years; the tools used in cultivation were depreciated over five years, so that the cost was spread over the same number of years; plastic buckets and bins were depreciated over three years; construction and improvements carried out by producers using GAPs were depreciated over five years.

It is important to note that cape gooseberry earnings vary according to farm size, fruit quality, farm management, exporter prices, market fluctuations, time of year, etc. The earnings represented here are an average for 1 hectare of production, under the implementation of GAP practices (Table 17). The study suggests that farmers who do not adopt GAPs tend to have a relative lower level of productivity (fruit quality and volume of export) than GAP adopters. An estimated cash flow statement for the GGAP and non-GAP group production schemes show higher net earnings for the GGAP farmers. Thus, the estimated net earnings for the GGAP and non-GAP production strategies were 28,255,964 COP ($14,128 USD) for the GGAP group, and 12,807,361 COP ($6,404 USD) for the non-GAP group. Though the GlobalGAP certification does not insure a price premium, the impact of high level GAP adoption may provide income gains through increased productivity and efficiency in farm management (lower costs). Similar results were observed in a pilot study of GLOBALGAP certification among small-scale farmers in Ghana, in which the farmers experienced increased incomes through increased productivity (Will 2010).

Table 17 – Estimated Baseline Costs of Production & Earnings for Cape Gooseberry, Boyacá, Colombia 2009, 18 Month Production Cycle (for 1 hectare)

	GLOBALGAP Certified	Non-GAP Certified
STANDARD EARNINGS*	**(Col pesos/ha)**	**(Col pesos/ha)**
Export market income	57,040,000	37,646,400
Domestic market income	1,984,000	67,456
Total income	**59,024,000**	**37,713,856**
VARIABLE COSTS		
Subtotal for Labor	9,395,500	8,538,070
Subtotal for Inputs	11,209,163	6,197,339
SERVICES		
Subtotal for Services	3,551,541	5,952,000
FIXED COSTS		
Subtotal for fixed costs	6,611,832	4,219,086
TOTAL COSTS OF PRODUCTION	**30,768,036**	**24,906,495**
Net Earnings	**28,255,964**	**12,807,361**

*Source: Boyacá State Government, 11/2009, standard earnings for 1 hectare of cape gooseberry production under GAPs. For the purpose of this study, non-GAP earnings estimated at two thirds of GAP production earnings.

Discussion

The results of the study indicated that small-scale cape gooseberry farmers, working together in organized farmer groups, in the Centro and Márquez regions of Boyacá were able to successfully make changes in order to meet the requirements of international markets, and experience some productivity and economic gains. The survey results indicated that the attendance at GAPs trainings and the subsequent adoption of key agricultural production and farm management practices had overall positive effects on farm productivity, farm worker welfare and environmental protection. The EGAP group (which followed GAP protocols designed by the exporter) and GGAP (GlobalGAP certified) groups showed many similarities in their GAP and food safety practices, while the NOGG group varied in their adoption of improved practices. The positive effects of GAPs adoption were indicated by the EGAP and GGAP groups' reported increases in fruit quality, the development of traceability systems, the installation of facilities to promote safe and hygenic practices among farm workers, reduced levels of chemcial use in cape gooseberry production, the increased use of organic materials, and improved adherence to maximum residue levels. Conversely, the lack of adoption to GAP protocols showed minimal improvements for the NOGG group. This was indicated by the non-certified farmers' reported lower level of advancement in farm production, fruit quality and market performance within the last two years (2007-2009). Other challenges by farmers with minimal GAP training and/or adoption included higher cost for soil amendments, which may be attributed to the common lack of soil analysis in their cape gooseberry production. According to Feola, Schoell and Binder (2010) small-scale farmers in Boyacá tend to over- or mis-use pesticides, and often wear insufficient or inappropriate personal proctective equipment, thus exposing themselves to a high level of health and environmental risks. Such behaviors show a need for improved agricultural extension and training in pesticide and/or other chemical use, and more sustainable agricultural production practices. These risks may be mitigated with the adoption of good agricultural practices.

Interviews with the respondents indicated that the early stages of the certification process often bear the greatest expenses, as farmers incur the costs of making drastic farm changes. GAP implementation costs varied from farm to farm, according to existing farm infrastructure, such as storage facilities, access to restroom and handwashing facilities, availability of production supplies, and farmer technical capacities. It also varied according to the farmers' linkages to local resources and training programs, as in most cases a strong network of agricultural assistance programs absorbs the costs of GAP training, monitoring and other certification costs. Other factors for production costs are the size of the farmer association (which relates to the amount of shared costs), and the farmer's access to buyer services (services provided by exporting enterprises, such as GAP training, seeds, fertilizer, credit, transport and certification fees).

Farmer interviews and partial budget analysis indicated that the largest production costs were the farm labor. During interviews, many farmers mentioned that the costs and management of the labor absorbed the greatest amount of their time and resources, along with the increased documentation. A report by Universidad Nacional (the National University) (2007) showed lower total costs of production for a locally well-known and successful GlobalGAP certified cape gooseberry farmer association, PROCAVEN. The PROCAVEN association had a larger farmer group membership and more experience with the GGAP certification and lower production costs than the GGAP survey respondents (who were newer to the GGAP certification). PROCAVEN also had a very strong network of support with local organizations. GGAP farms may show a gradual increase in farm efficiency when comparing the costs of GAP management over time. This, along with increased productivity, allowed GGAP certified farmers to experience higher net earnings than the NOGG group. However as GAP certification requirements continue to evolve, only long-term monitoring and evaulation of certified farmer groups' costs and earnings will provide a clear understanding of the impacts and sustainability of the certification.

Though GAP and food safety standards are increasingly required by retailers, currently there is no price premium paid to producers for GAPs or GlobalGAP certification. Though exporters did not pay higher prices for GAP certified labels, slightly higher prices were paid for higher quality products. Prices also varied slightly according to exporters. Despite the limited price incentives, for many of the farmers, the exporter's requirement for GAP protocols was sufficient incentive. One exporter indicated that GAP certification may insure a higher price for producers in the future. Follow-up interviews with individual farmers and farmer groups indicated that there had been an improved understanding (as a result of GAPs and food safety training) of the importance of GAP practices. However interviews with representatives of export firms and technical coordinators suggested that there remains a strong lack of GAP and techinical knowledge among the farmers. "*There is still a great need for improved technical capacities*," said one exporter representative, speaking of the need for improvements in effective disease management and pest control. Exporters recognized that it will take time to raise technical, market-oriented expertise among small-scale farmers. Indeed, the transition from traditional production practices to highly structured protocols and training in crop production, disease management, etc., is a process, not an event. However, with a burgeoning market for cape gooseberry in Europe and a strong production base in Boyacá, some exporters were willing to make the investment in small-scale farmer production. They continue to support their growers in monthly technical assistance consultations, as well as through training programs offered through public-private partnerships. Their goal is to maintain their support to the farmers in order to ensure a high quality product for the European market.

It is important to recognize that the small farmers who were successfully engaged in GAP adoption were able to do so largely due to their participation in organized farmer groups (who shared in certification expenses, labor, inputs, etc.) and their linkages to public-private support. Small farmers working within organized groups as a strategy for engaging in market competitiveness activities is documented in literature (Henson, Masakure and Boselie 2005, Roy and Thorat 2007, Berdegue, Bienabe and Peppelenbos 2008, van der Valk and van der Roest 2009). The support and technical assistance provided by public and private sector entities, such as Agromárquez, SENA, ASOHOFRUCOL, CCI, the Boyacá state government, the Ministry of Agriculture, exporters, and others were essential aspects of the implementation process. GAP training and implementation, market information, group formation, leadership skills, budget management, and small agribusiness development training are some of the resources provided by these linkages.

Though the results showed that some farmers were able to successfully implement GAP protocols on their farms, better coordination of resources and information dissemination could expand the impact of these programs. Through conversations during farmer interviews, it was clear that some farmers were not aware of all of the resources available to them, nor the processes or benefits of accessing and using the resources. Understandably, there were often considerable barriers to accessing resources, such as limited transportation, limited rural infrastructure (non-paved roads, limited access to the internet and fresh produce market information, etc), and long distances to government, non-profit and private sector offices. While some technical assistance programs were working to mitigate these circumstances, their efforts could be maximized by improved outreach, coordination and and regular follow-up meetings with farmers. Furthermore, the government's investment in GAP implementation programs would be better served by additional investment in rural infrastructure.

This study attempted to provide a deeper understanding of some of the characteristics and experiences of 'on-the-ground' adoption of GAP and food safety standards among small-scale farmers. Though limited in its size and scope, the study showed that for 27 farmers, with relative proximity to the same resources for full compliance with food safety standards, adoption behaviors were quite different. This suggests that the presence alone of resources does not ensure the ulitilization of the resources, and there is no 'one size fits all' solution for small-scale growers who are farming within complex rural environments. Indeed, as Chambers (1997) contends, *"Many poor people's realities are local, complex, diverse, dynamic and unpredictable."* The process for transferring improved technologies, resources, and linking small-scale farmers to global markets continues to require innovative, wholistic strategies, and long-term investment and research. For the farmers, it requires not only advancements in technical capacities but it demands a cultural paradigm shift from local norms and practices to highly regimented, systemitized production protocols. According to Kleinwechter and Grethe (2006), the success of the "information stage" is an important factor which influences the decision for or against the adoption of the GLOBALGAP certification. It is a time for learning new information and gaining farmer 'buy-in' as they weigh the new information (i.e., the need for GAPs, food safety, international market requirements) against their own traditional farming (and consumer) experiences. Additionally, issues such as the long-term access to capital, training and market information must be addressed to ensure the sustainability of small-scale farmers within these knew production paradigms. Furthermore, barriers such as literacy, rural infrastructure (roads, potable water, information communication technologies) and the availability of third-party certification organizations provide a different set of complex challenges. The need for a wholistic approach in the transition towards a more sustainable, market-oriented small-scale production requires long-term commitment and investment from many sectors.   Therefore the decision towards GAP and food safety adoption lies not only with the farmers, but with the supporting institutions: exporters, government officials and technical training organizations, etc., whether they will commit to the sustainability of the farmer programs.

While some may view international GAP and food safety standards as an oppressionist imposition of foreign standards, others may view them as a catalyst for growth, advancement, rural livelihood development, improved environmental protection, and an improved food supply.   The study shows a measure of success in the GAP implementation process among small-scale cape goosebery farmers in Boyacá, however it is too soon to understand the long-term impacts. A follow-up study to the region in five or six years would provide valuable insight into the longer-term impacts on production, farmer and farm-worker welfare and technical capacities, environmental conditions, and farm profitability.

APPENDIX 1

ANOVA for Respondents' GAP Training and Farm Documentation Practices

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Attend GAP trainings/yr	Between Groups	5696.098	2	2848.049	23.635	<0.001
	Within Groups	2891.976	24	120.499		
	Total	8588.074	26			
Training hours/year	Between Groups	206719.249	2	103359.624	23.317	<0.001
	Within Groups	106385.048	24	4432.710		
	Total	313104.296	26			
Documentation hrs/week	Between Groups	27.250	2	13.625	2.841	0.078
	Within Groups	115.088	24	4.795		
	Total	142.338	26			
All workers GAP trained	Between Groups	.860	2	.430	3.210	0.058
	Within Groups	3.214	24	.134		
	Total	4.074	26			
Traceability change	Between Groups	3.241	2	1.620	46.667	<0.001
	Within Groups	.833	24	.035		
	Total	4.074	26			
Production costs records	Between Groups	.130	2	.065	1.867	0.176
	Within Groups	.833	24	.035		
	Total	.963	26			
Cape gooseberry income records	Between Groups	.090	2	.045	.613	0.550
	Within Groups	1.762	24	.073		
	Total	1.852	26			

APPENDIX 2

Tukey HSD Test for Respondents' GAP Training and Farm Documentation Practices

Tukey HSD

Dependent Variable	(I) Group Type	(J) Group Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Attend GAP trainings/yr	Exporter GAP	Global GAP Certified	32.143*	5.081	<0.001	19.45	44.83
		Non-GAP Certified	24.405*	5.356	<0.001	11.03	37.78
	Global GAP Certified	Exporter GAP	-32.143*	5.081	<0.001	-44.83	-19.45
		Non-GAP Certified	-7.738	6.107	0.427	-22.99	7.51
	Non-GAP Certified	Exporter GAP	-24.405*	5.356	<0.001	-37.78	-11.03
		Global GAP Certified	7.738	6.107	0.427	-7.51	22.99
Training hours/year	Exporter GAP	Global GAP Certified	188.571*	30.820	<0.001	111.61	265.54
		Non-GAP Certified	156.333*	32.487	<0.001	75.20	237.46
	Global GAP Certified	Exporter GAP	-188.571*	30.820	<0.001	-265.54	-111.61
		Non-GAP Certified	-32.238	37.041	0.664	-124.74	60.26
	Non-GAP Certified	Exporter GAP	-156.333*	32.487	<0.001	-237.46	-75.20
		Global GAP Certified	32.238	37.041	0.664	-60.26	124.74
Traceability change	Exporter GAP	Global GAP Certified	0.000	0.086	1.000	-0.22	0.22
		Non-GAP Certified	0.833*	0.091	<0.001	0.61	1.06
	Global GAP Certified	Exporter GAP	0.000	0.086	1.000	-0.22	0.22
		Non-GAP Certified	0.833*	0.104	<0.001	0.57	1.09
	Non-GAP Certified	Exporter GAP	-0.833*	0.091	<0.001	-1.06	-0.61
		Global GAP Certified	-0.833*	0.104	<0.001	-1.09	-0.57

*. The mean difference is significant at the 0.05 level.

APPENDIX 3

ANOVA for Respondents' Production Practices

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Water analysis	Between Groups	2.310	2	1.155	11.758	<0.001
	Within Groups	2.357	24	0.098		
	Total	4.667	26			
Agronomist	Between Groups	1.169	2	0.585	2.519	0.102
	Within Groups	5.571	24	0.232		
	Total	6.741	26			
Avg.yield (kg/plant)	Between Groups	278.337	2	139.168	16.156	<0.001
	Within Groups	198.125	23	8.614		
	Total	476.462	25			

APPENDIX 4

Tukey HSD Tests for Respondents' Production Practices

Dependent Variable	(I) Group Type	(J) Group Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Water analysis	Exporter GAP	Global GAP Certified	-0.643*	0.145	0.001	-1.01	-0.28
		Non-GAP Certified	0.071	0.153	0.887	-0.31	0.45
	Global GAP Certified	Exporter GAP	0.643*	0.145	0.001	0.28	1.01
		Non-GAP Certified	0.714*	0.174	0.001	0.28	1.15
	Non-GAP Certified	Exporter GAP	-0.071	0.153	0.887	-0.45	0.31
		Global GAP Certified	-0.714*	0.174	0.001	-1.15	-0.28
Agronomist	Exporter GAP	Global GAP Certified	0.500	0.223	0.084	-0.06	1.06
		Non-GAP Certified	0.143	0.235	0.817	-0.44	0.73
	Global GAP Certified	Exporter GAP	-0.500	0.223	0.084	-1.06	0.06
		Non-GAP Certified	-0.357	0.268	0.392	-1.03	0.31
	Non-GAP Certified	Exporter GAP	-0.143	0.235	0.817	-0.73	0.44
		Global GAP Certified	0.357	0.268	0.392	-0.31	1.03
Avg.yield (kg/plant)	Exporter GAP	Global GAP Certified	-5.956*	1.376	0.001	-9.40	-2.51
		Non-GAP Certified	2.949	1.449	.126	-.68	6.58
	Global GAP Certified	Exporter GAP	5.956*	1.376	0.001	2.51	9.40
		Non-GAP Certified	8.905*	1.633	0.000	4.82	12.99
	Non-GAP Certified	Exporter GAP	-2.949	1.449	0.126	-6.58	.68
		Global GAP Certified	-8.905*	1.633	0.000	-12.99	-4.82

*The mean difference is significant at the 0.05

APPENDIX 5

ANOVA for Respondents' Changes in GAP & Food Safety Practices

Change in GAP & Food Safety Practices		Sum of Squares	df	Mean Square	F	Sig.
Water source	Between Groups	.119	2	.060	.314	0.733
	Within Groups	4.548	24	.189		
	Total	4.667	26			
Irrigation water mgmt	Between Groups	3.452	2	1.726	12.889	<0.001
	Within Groups	3.214	24	.134		
	Total	6.667	26			
Fertilizer amount	Between Groups	.762	2	.381	1.548	0.233
	Within Groups	5.905	24	.246		
	Total	6.667	26			
Fertilizer type	Between Groups	2.582	2	1.291	10.167	0.001
	Within Groups	3.048	24	.127		
	Total	5.630	26			
Manure application	Between Groups	2.476	2	1.238	7.091	0.004
	Within Groups	4.190	24	.175		
	Total	6.667	26			
Compost application	Between Groups	2.122	2	1.061	5.512	0.011
	Within Groups	4.619	24	.192		
	Total	6.741	26			
Pesticide application	Between Groups	2.566	2	1.283	11.758	0.000
	Within Groups	2.619	24	.109		
	Total	5.185	26			
On-farm fruit collection	Between Groups	2.042	2	1.021	5.475	0.011
	Within Groups	4.476	24	.187		
	Total	6.519	26			
Farm worker training	Between Groups	1.812	2	.906	9.614	0.001
	Within Groups	2.262	24	.094		
	Total	4.074	26			
Hand-washing facility install	Between Groups	1.812	2	.906	9.614	0.001
	Within Groups	2.262	24	.094		
	Total	4.074	26			
Worker restroom install	Between Groups	1.619	2	.810	6.375	0.006
	Within Groups	3.048	24	.127		

	Total	4.667	26			
Traceability change	Between Groups	3.241	2	1.620	46.667	0.000
	Within Groups	.833	24	.035		
	Total	4.074	26			
GAP Index	Between Groups	1.072	2	.536	12.976	0.000
	Within Groups	.992	24	.041		
	Total	2.064	26			

APPENDIX 6

Tukey HSD Test for Respondents' Changes in GAP & Food Safety Practices

Tukey HSD

GAP & Food Safety Practices Change	(I) Group Type	(J) Group Type	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Water source	Exporter GAP	Global GAP Certified	0.143	0.202	0.761	-0.36	0.65
		Non-GAP Certified	0.119	0.212	0.842	-0.41	0.65
	Global GAP Certified	Exporter GAP	-0.143	0.202	0.761	-0.65	0.36
		Non-GAP Certified	-0.024	0.242	0.995	-0.63	0.58
	Non-GAP Certified	Exporter GAP	-0.119	0.212	0.842	-0.65	0.41
		Global GAP Certified	0.024	0.242	0.995	-0.58	0.63
Irrigation water management	Exporter GAP	Global GAP Certified	0.643*	0.169	0.002	0.22	1.07
		Non-GAP Certified	0.786*	0.179	0.001	0.34	1.23
	Global GAP Certified	Exporter GAP	-0.643*	0.169	0.002	-1.07	-0.22
		Non-GAP Certified	0.143	0.204	0.765	-0.37	0.65
	Non-GAP Certified	Exporter GAP	-0.786*	0.179	0.001	-1.23	-0.34
		Global GAP Certified	-0.143	0.204	0.765	-0.65	0.37
Fertilizer amount	Exporter GAP	Global GAP Certified	0.286	0.230	0.440	-0.29	0.86
		Non-GAP Certified	0.381	0.242	0.276	-0.22	0.99
	Global GAP Certified	Exporter GAP	-0.286	0.230	0.440	-0.86	0.29
		Non-GAP Certified	0.095	0.276	0.937	-0.59	0.78
	Non-GAP Certified	Exporter GAP	-0.381	0.242	0.276	-0.99	0.22
		Global GAP Certified	-.0095	0.276	0.937	-0.78	0.59
Fertilizer type	Exporter GAP	Global GAP Certified	0.571*	0.165	0.006	0.16	0.98
		Non-GAP Certified	0.667*	0.174	0.002	0.23	1.10
	Global GAP Certified	Exporter GAP	-0.571*	0.165	0.006	-0.98	-0.16

		Non-GAP Certified	0.095	0.198	0.881	-0.40	0.59
	Non-GAP Certified	Exporter GAP	-0.667*	0.174	0.002	-1.10	-0.23
		Global GAP Certified	-0.095	0.198	0.881	-0.59	0.40
Manure application	Exporter GAP	Global GAP Certified	0.714*	0.193	0.003	0.23	1.20
		Non-GAP Certified	0.381	0.204	0.170	-0.13	0.89
	Global GAP Certified	Exporter GAP	-0.714*	0.193	0.003	-1.20	-0.23
		Non-GAP Certified	-0.333	0.232	0.340	-0.91	0.25
	Non-GAP Certified	Exporter GAP	-0.381	0.204	0.170	-0.89	0.13
		Global GAP Certified	0.333	0.232	0.340	-0.25	0.91
Compost application	Exporter GAP	Global GAP Certified	0.500	0.203	0.054	-0.01	1.01
		Non-GAP Certified	0.619*	0.214	0.021	0.08	1.15
	Global GAP Certified	Exporter GAP	-0.500	0.203	0.054	-1.01	0.01
		Non-GAP Certified	0.119	0.244	0.878	-0.49	0.73
	Non-GAP Certified	Exporter GAP	-0.619*	0.214	0.021	-1.15	-0.08
		Global GAP Certified	-0.119	0.244	0.878	-0.73	0.49
Pesticide application	Exporter GAP	Global GAP Certified	0.071	0.153	0.887	-0.31	0.45
		Non-GAP Certified	0.762*	0.161	<0.001	0.36	1.16
	Global GAP Certified	Exporter GAP	-0.071	0.153	0.887	-0.45	0.31
		Non-GAP Certified	0.690*	0.184	0.003	0.23	1.15
	Non-GAP Certified	Exporter GAP	-0.762*	0.161	<0.001	-1.16	-0.36
		Global GAP Certified	-.0690*	0.184	0.003	-1.15	-0.23
On-farm fruit collection	Exporter GAP	Global GAP Certified	0.571*	0.200	0.023	0.07	1.07
		Non-GAP Certified	.524	0.211	0.051	0.00	1.05
	Global GAP Certified	Exporter GAP	-0.571*	0.200	0.023	-1.07	-0.07
		Non-GAP Certified	-0.048	0.240	0.979	-0.65	0.55
	Non-GAP Certified	Exporter GAP	-0.524	0.211	0.051	-1.05	0.00
		Global GAP Certified	0.048	0.240	0.979	-0.55	0.65
Farm worker training	Exporter GAP	Global GAP Certified	-0.071	0.142	0.871	-0.43	0.28

		Non-GAP Certified	0.595*	0.150	0.002	0.22	0.97
	Global GAP Certified	Exporter GAP	0.071	0.142	0.871	0-.28	0.43
		Non-GAP Certified	0.667*	0.171	0.002	0.24	1.09
	Non-GAP Certified	Exporter GAP	-.0595*	0.150	0.002	-0.97	-0.22
		Global GAP Certified	-0.667*	0.171	0.002	-1.09	-0.24
Hand-washing facility install	Exporter GAP	Global GAP Certified	-0.071	0.142	0.871	-0.43	0.28
		Non-GAP Certified	0.595*	0.150	0.002	0.22	0.97
	Global GAP Certified	Exporter GAP	0.071	0.142	0.871	-0.28	0.43
		Non-GAP Certified	0.667*	0.171	0.002	0.24	1.09
	Non-GAP Certified	Exporter GAP	-0.595*	0.150	0.002	-0.97	-0.22
		Global GAP Certified	-0.667*	0.171	0.002	-1.09	-0.24
Worker restroom install	Exporter GAP	Global GAP Certified	-0.143	0.165	0.666	-0.55	0.27
		Non-GAP Certified	0.524*	00.174	0.016	0.09	0.96
	Global GAP Certified	Exporter GAP	0.143	0.165	0.666	-0.27	0.55
		Non-GAP Certified	0.667*	0.198	0.007	0.17	1.16
	Non-GAP Certified	Exporter GAP	-0.524*	0.174	0.016	-0.96	-0.09
		Global GAP Certified	-0.667*	0.198	0.007	-1.16	-0.17
Traceability change	Exporter GAP	Global GAP Certified	0.000	0.086	1.000	-0.22	0.22
		Non-GAP Certified	0.833*	0.091	.000	0.61	1.06
	Global GAP Certified	Exporter GAP	0.000	0.086	1.000	-0.22	0.22
		Non-GAP Certified	0.833*	0.104	<0.001	0.57	1.09
	Non-GAP Certified	Exporter GAP	-0.833*	0.091	<0.001	-1.06	-0.61
		Global GAP Certified	-0.833*	0.104	<0.001	-1.09	-0.57
GAP Index	Exporter GAP	Global GAP Certified	0.16327	0.094	0.213	-0.0717	0.3982
		Non-GAP Certified	.50510*	0.099	<0.001	0.2574	00.7528
	Global GAP Certified	Exporter GAP	-0.16327	0.094	0.213	-0.3982	0.0717
		Non-GAP Certified	0.34184*	0.113	0.016	0.0594	0.6242

	Non-GAP Certified	Exporter GAP	-0.50510*	0.099	<0.001	-0.7528	-0.2574
		Global GAP Certified	-0.34184*	0.113	0.016	-0.6242	-0.0594

*. The mean difference is significant at the 0.05 level.

APPENDIX 7

ANOVA for Respondents' Horticultural Production Challenges

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Weeds	Between Groups	2.405	2	1.202	12.758	<0.001
	Within Groups	2.262	24	0.094		
	Total	4.667	26			
Fungus on calyx	Between Groups	1.939	2	0.970	6.305	0.006
	Within Groups	3.690	24	0.154		
	Total	5.630	26			
Nutrient deficiencies	Between Groups	2.193	2	1.097	5.787	0.009
	Within Groups	4.548	24	0.189		
	Total	6.741	26			
Small fruit size	Between Groups	1.952	2	0.976	4.970	0.016
	Within Groups	4.714	24	0.196		
	Total	6.667	26			
Non-uniform fruit size	Between Groups	2.976	2	1.488	9.677	0.001
	Within Groups	3.690	24	0.154		
	Total	6.667	26			

APPENDIX 8

Tukey Honestly Significant Difference (HSD) Test for Respondents' Reported Horticultural Production Challenges

Dependent Variable	(I) Group Type	(J) Group Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Weeds	GGAP Certified	Exporter GAP	-0.71*	0.14	<0.001	-1.07	-0.36
		No GAP Certification	-0.54*	0.17	0.010	-0.97	-0.12
	Exporter GAP	GGAP Certified	0.71*	0.14	<0.001	0.36	1.07
		No GAP Certification	0.16	0.15	0.516	-0.21	0.54
	No GAP Certification	GGAP Certified	0.54*	0.17	0.010	0.12	0.97
		Exporter GAP	-0.16	0.15	0.516	-0.54	0.21
Fungus on calyx	GGAP Certified	Exporter GAP	-0.64*	0.18	0.005	-1.10	-0.19
		No GAP Certification	-0.38	0.21	0.209	-0.93	0.16
	Exporter GAP	GGAP Certified	0.64*	0.18	0.005	0.19	1.10
		No GAP Certification	0.26	0.19	0.373	-0.22	0.74
	No GAP Certification	GGAP Certified	0.38	0.21	0.209	-0.16	0.93
		Exporter GAP	-0.26	0.19	0.373	-0.74	0.22
Nutrient deficiencies	GGAP Certified	Exporter GAP	-0.64*	0.20	0.011	-1.15	-0.14
		No GAP Certification	-0.19	0.24	0.715	-0.80	0.41
	Exporter GAP	GGAP Certified	0.64*	0.20	0.011	0.14	1.15
		No GAP Certification	0.45	0.21	0.105	-0.08	0.98
	No GAP Certification	GGAP Certified	0.19	0.24	0.715	-0.41	0.80
		Exporter GAP	-0.45	0.21	0.105	-0.98	0.08
Small fruit size	GGAP Certified	Exporter GAP	-0.64*	0.21	0.012	-1.16	-0.13
		No GAP Certification	-0.50	0.25	0.127	-1.12	0.12
	Exporter GAP	GGAP Certified	0.64*	0.21	0.012	0.13	1.16

		No GAP Certification	0.14	0.21	0.788	-0.40	0.68
	No GAP Certification	GGAP Certified	0.50	0.24	0.127	-0.12	1.12
		Exporter GAP	-0.14	0.21	0.788	-0.68	0.40
Non-uniform fruit size	GGAP Certified	Exporter GAP	-0.78*	0.18	0.001	-1.24	-0.33
		No GAP Certification	-0.66*	0.21	0.014	-1.21	-0.12
	Exporter GAP	GGAP Certified	0.78*	0.18	0.001	0.33	1.24
		No GAP Certification	0.11	0.19	0.809	-0.36	0.60
	No GAP Certification	GGAP Certified	0.66*	0.21	0.014	0.12	1.21
		Exporter GAP	-0.11	0.19	0.809	-0.60	0.36

*. The mean difference is significant at the 0.05 level.

APPENDIX 9

ANOVA for Respondents' Reported Impacts of Adoption of GAP & Food Safety Practices

ANOVA – Respondents' Reported GAP Impacts

		Sum of Squares	df	Mean Square	F	Sig.
% Fruit quality change	Between Groups	9228.836	2	4614.418	7.932	0.002
	Within Groups	13961.905	24	581.746		
	Total	23190.741	26			
% Selling price change	Between Groups	264.550	2	132.275	22.222	<0.001
	Within Groups	142.857	24	5.952		
	Total	407.407	26			
% No. of buyers change	Between Groups	380.952	2	190.476	6.667	0.005
	Within Groups	685.714	24	28.571		
	Total	1066.667	26			
% Income change	Between Groups	199.471	2	99.735	.677	0.518
	Within Groups	3535.714	24	147.321		
	Total	3735.185	26			
% Production costs change	Between Groups	13386.772	2	6693.386	32.832	<0.001
	Within Groups	4892.857	24	203.869		
	Total	18279.630	26			
% Savings ability change	Between Groups	154.762	2	77.381	2.609	0.094
	Within Groups	711.905	24	29.663		
	Total	866.667	26			
% Farmer GAPs knowledge change	Between Groups	4512.169	2	2256.085	3.668	0.041
	Within Groups	14761.905	24	615.079		
	Total	19274.074	26			
% Worker GAPs knowledge change	Between Groups	5571.429	2	2785.714	4.509	0.022
	Within Groups	14828.571	24	617.857		
	Total	20400.000	26			
% Volume export quality fruit change	Between Groups	17261.905	2	8630.952	21.455	<0.001
	Within Groups	9654.762	24	402.282		
	Total	26916.667	26			
% Price variability change	Between Groups	42.328	2	21.164	3.556	0.044
	Within Groups	142.857	24	5.952		
	Total	185.185	26			

APPENDIX 10

Tukey HSD Comparison Test for Respondents' Reported Impacts of Adoption of GAP & Food Safety Practices

Dependent Variable	(I) Group Type	(J) Group Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
% Fruit quality change	Exporter GAP	Global GAP Certified	37.857*	10.089	0.003	12.66	63.05
		Non-GAP Certified	40.119*	10.634	0.003	13.56	66.68
	Global GAP Certified	Exporter GAP	-37.857*	10.089	0.003	-63.05	-12.66
		Non-GAP Certified	2.262	12.125	0.981	-28.02	32.54
	Non-GAP Certified	Exporter GAP	-40.119*	10.634	0.003	-66.68	-13.56
		Global GAP Certified	-2.262	12.125	0.981	-32.54	28.02
% Selling price change	Exporter GAP	Global GAP Certified	-7.143*	1.129	<0.00	-9.96	-4.32
		Non-GAP Certified	0.000	1.190	1.000	-2.97	2.97
	Global GAP Certified	Exporter GAP	7.143*	1.129	<0.001	4.32	9.96
		Non-GAP Certified	7.143*	1.357	<0.001	3.75	10.53
	Non-GAP Certified	Exporter GAP	.000	1.190	1.000	-2.97	2.97
		Global GAP Certified	-7.143*	1.357	<0.001	-10.53	-3.75
% No. of buyers change	Exporter GAP	Global GAP Certified	-8.571*	2.474	0.006	-14.75	-2.39
		Non-GAP Certified	0.000	2.608	1.000	-6.51	6.51
	Global GAP Certified	Exporter GAP	8.571*	2.474	0.006	2.39	14.75
		Non-GAP Certified	8.571*	2.974	0.022	1.14	16.00
	Non-GAP Certified	Exporter GAP	0.000	2.608	1.000	-6.51	6.51
		Global GAP Certified	-8.571*	2.974	0.022	-16.00	-1.14
% Production costs change	Exporter GAP	Global GAP Certified	47.857*	6.610	<0.001	31.35	64.36
		Non-GAP Certified	40.000*	6.967	<0.001	22.60	57.40
	Global GAP Certified	Exporter GAP	-47.857*	6.610	<0.001	-64.36	-31.35
		Non-GAP Certified	-7.857	7.944	0.591	-27.69	11.98
	Non-GAP Certified	Exporter GAP	-40.000*	6.967	<0.001	-57.40	-22.60
		Global GAP Certified	7.857	7.944	0.591	-11.98	27.69
% Farmer GAP knowledge change	Exporter GAP	Global GAP Certified	14.286	11.481	0.440	-14.38	42.96
		Non-GAP Certified	32.381*	12.102	0.034	2.16	62.60
	Global GAP Certified	Exporter GAP	-14.286	11.481	0.440	-42.96	14.38

		Non-GAP Certified	18.095	13.798	0.403	-16.36	52.55
	Non-GAP Certified	Exporter GAP	-32.381*	12.102	0.034	-62.60	-2.16
		Global GAP Certified	-18.095	13.798	0.403	-52.55	16.36
% Worker GAP knowledge change	Exporter GAP	Global GAP Certified	4.286	11.506	0.927	-24.45	33.02
		Non-GAP Certified	35.714*	12.129	0.019	5.43	66.00
	Global GAP Certified	Exporter GAP	-4.286	11.506	0.927	-33.02	24.45
		Non-GAP Certified	31.429	13.829	0.079	-3.11	65.96
	Non-GAP Certified	Exporter GAP	-35.714*	12.129	0.019	-66.00	-5.43
		Global GAP Certified	-31.429	13.829	0.079	-65.96	3.11
% Volume of export quality fruit change	Exporter GAP	Global GAP Certified	50.714*	5.879	<0.001	36.03	65.40
		Non-GAP Certified	62.143*	6.197	<0.001	46.67	77.62
	Global GAP Certified	Exporter GAP	-50.714*	5.879	<0.001	-65.40	-36.03
		Non-GAP Certified	11.429	7.066	0.258	-6.22	29.07
	Non-GAP Certified	Exporter GAP	-62.143*	6.197	<0.001	-77.62	-46.67
		Global GAP Certified	-11.429	7.066	.258	-29.07	6.22
% Price variability change	Exporter GAP	Global GAP Certified	-2.857*	1.129	0.047	-5.68	-0.04
		Non-GAP Certified	0.000	1.190	1.000	-2.97	2.97
	Global GAP Certified	Exporter GAP	2.857*	1.129	0.047	0.04	5.68
		Non-GAP Certified	2.857	1.357	0.110	-0.53	6.25
	Non-GAP Certified	Exporter GAP	0.000	1.190	1.000	-2.97	2.97
		Global GAP Certified	-2.857	1.357	0.110	-6.25	0.53

*. The mean difference is significant at the 0.05 level.

APPENDIX 11

CODE:__________

Farmer Survey (English)

Location:

____

Date:

BACKGROUND INFORMATION

1) Do you practice Good Agricultural Practices (GAPs) in your uchuva production? ☐ Yes ☐ No

2) Please indicate which, if any, programs you know of, are certified in, **and/or** are working toward. Please indicate whether certified individually or within a farmer group (please give quantity of farmers within your group):

	Familiar with	**I have**	**In process**	**Individ.**	**Group/Qty**
ColombiaGAP	☐	☐	☐	☐	☐/_____
GLOBALGAP	☐	☐	☐	☐	☐/_____
NTC (Norma Técnica Colombiana)	☐	☐	☐	☐	☐ /____
USDA/APHIS Certification (USA)	☐	☐	☐	☐	☐/_____
Plant Health Certificate (Europe)	☐	☐	☐	☐	☐/_____
Certificacion Orgánica	☐	☐	☐	☐	☐/_____
Global Food Safety Initiative	☐	☐	☐	☐	☐/_____
Other ____________________	☐	☐	☐	☐	☐

/_____

3) For how many years have you been growing uchuva? __________

4) What is the annual fee for your farm's certification? ________ How many years certified?___________

5) How often do you participate in educational trainings for food safety standards?

☐ 1 Meeting/year ☐ 2 Meetings/year ☐ Other: ____________________

6) How far do you travel for the trainings? ______________________(kilometers)

7) How many hours do you spend each week or each month on record keeping or reporting for GAPs certification?

_________________ hours/week **or** __________________ hours/month

8) What is the name of your certifying organization? ___________________________

9) On how many hectares do you produce uchuva? _______ Do all workers receive GAPs training?

☐ Yes ☐ No

10) How many people work on your uchuva production? ______ How many of the people are paid? _______

How many of the people are family members? ______ How many family members are paid? __________

11) How many workers are for production?___________ How many are for harvesting? __________________

12) How often is your uchuva crop monitored for pests and diseases, and by whom? _____________________________

PRÁCTICAS DEL CULTIVO
Which do you use for your production? ☐Seeds ☐ Transplants: (age of transplants)_____________
Is the water analyzed by a laboratory? ☐Yes ☐ No How often?
Is the soil analyzed by a laboratory? ☐Yes ☐ No How often?
What fertilizers do you use? At what rate? How often?
What are your production's primary insect infestations? What are your methods of control, and at what rates/concentrations?
What are the primary diseases? What are the methods of control and the rates/concentrations?
Do you have a significant problem with weeds? ☐Yes ☐No If yes, what are your methods of control?
Which trellis system do you use in your production? ☐ System T ☐ System V ☐ Other :_______________
When do you start the pruning? How often?
When did/do you start the harvest? How often do you harvest?
Which of the following are frequent problems with your crop? ☐ Cracks in fruit ☐ Fungus in the fruit ☐ Fungus on the calyx ☐ insect damage ☐ diseases ☐plant nutrient deficiency ; which ? _________________ ☐ excess water ☐ water deficiency ☐ small fruit size ☐ non-uniform fruit size and shape ☐ non-uniform fruit color
Is there a specific uchuva variety that you use? If so please write the name of the variety :
What is the average duration of your uchuva production?
Approximately how have your costs of production changed, due to GAP implementation? Please choose one. ☐ No change ☐ Decreased by __10% ___20% ___30% ☐ Increased by __10% ___20% ____30%

PRODUCTION MANAGEMENT		
Please tell us where you have made changes to your farm management for food safety certification for uchuva: (if not certified, please answer about changes in the last 2 years)		
Yes	**Area of management**	**What was the change and why?**
☐	Irrigation water source	
☐	Irrigation water handling	
☐	Irrigation water quantity	
☐	Irrigation water testing	
☐	Fertilizer rates	
☐	Fertilizer product	
☐	Manure application to uchuva	
☐	Compost application to uchuva	
☐	Pesticide applications	
☐	Product transportation on farm	
☐	Pruning	
☐	Worker training in food safety	
☐	Hand-washing facilities	
☐	Toilet facilities	
☐	Traceability	
☐	Plant density/hectare	Please list:
☐	Plant spacing & row spacing	Please list:

AGROECOLOGICAL CHARACTERISTICS

Farm altitude: __________ Avg. Temperature:________ Annual precipitation: ____________

Soil type: ___________________ Avg. Yield: ______________

CERTIFICATION IMPACTS				
How has food safety certification affected the following:	**HIGHER**	**LOWER**	**SAME**	**% ↑ OR ↓**
Your product quality?				
Your selling price?				

How has food safety certification affected the following:	**HIGHER**	**LOWER**	**SAME**	**% ↑ OR ↓**
Your number of buyers?				
Your annual income?				
Your total uchuva expenses?				
Your ability to save money?				
Your uchuva food safety knowledge & practices?				
Your uchuva workers' food safety knowledge & practices?				
Your volume of good quality uchuva?				
Your price variability?				
Your access to markets?				

MARKET INFORMATION

Market Channels: To whom do you sell your uchuva?
☐ Intermediary ☐ Exporter ☐ Wholesaler ☐ Processing Firm ☐ Farmer's Market ☐ Other___________________

What is your highest price for uchuva? _________________ Your lowest price? ___________________

Services provided by your buyers? ☐ GAPs ☐ Seed ☐ Fertilizer ☐ Credit ☐ Transportation ☐ Certification fees

What type of contract do you have with your buyers? ☐ Oral ☐ Formal/written ☐ No contract

For how many years have you been selling uchuva to the current buyer? ______
How often are you paid by the buyer? __________ How much do you sell to them at each time? _______kg

Do you keep records of production costs? ☐ Yes ☐ No Or uchuva earnings? ☐ Yes ☐ No

DEMOGRAPHICS

Gender ☐ Male ☐ Female
Age: ☐ < 25 ☐ 25-30 ☐31-40 ☐41-50 ☐ > 50
Number of family members living with you: __

What approximate percentage of your total household income comes from your uchuva sales?
☐10 ☐20 ☐30 ☐40 ☐ 50
☐60 ☐70 ☐80 ☐90 ☐ 100

Level of education completed:
☐ 4th grade or less ☐ 8th grade or less
☐ 1-3 years of high school ☐ completed high school
☐ University graduate ☐ Other_____________

Total Farm Income: ______________________pesos
Total Uchuva Income: ____________________pesos

APPENDIX 12

CODE:_________

Farmer Survey (Spanish)

Nombre:______________________
Fecha:____________________

Locación de la finca:
____
____

INFORMACIÓN de ANTECEDENTES

1) Usted aplica buenas prácticas agrícolas (bpa) en su producción de uchuva ? ☐ Sí ☐ No

2) Por favor, marca que, en su caso, los programas que conoce, está certificados en, o está trabajando. Sírvase indicar si certificadas individualmente o con un grupo de agricultores (indique la cantidad de los agricultores de su grupo):

	Lo conozco	**Lo tengo**	**En proceso**	**Solo**	**Grupo/No.**
ColombiaBPA	☐	☐	☐	☐	☐/_____
GLOBALGAP	☐	☐	☐	☐	☐/_____
NTC (Norma Técnica Colombiana)	☐	☐	☐	☐	☐ /____
Certificación de USDA/APHIS	☐	☐	☐	☐	☐/_____
Certificación de fitosanitaria	☐	☐	☐	☐	☐/_____
Certificación Orgánica	☐	☐	☐	☐	☐/_____
Iniciativa Global de Alimento Sano	☐	☐	☐	☐	☐/____

3) ¿Por cuántos años has estado en el cultivo de la uchuva?__________

4) ¿Cuánto paga cada año por la certificación de su finca ?________ ¿Cuántos años lleva certificado?___________

5) ¿Con qué frecuencia asiste a los talleres educativos de las normas de alimento sano o buenas prácticas agrícolas?
☐ 1 vez/ año ☐ 2 veces/ año ☐ Otra: ________________ ¿Cuántos horas está en los talleres ? __________

6) ¿Cuántos kilometros viaja para los tallers? ______________________ ¿Cuántas horas viajando ? ______

7) ¿Cuántas horas pasa usted cada semana o cada mes en el mantenimiento de registros o informes para la certificación de BPA?_________________ horas/semana **o** __________________ horas/mes

8) ¿Cuál es el nombre de su organización de certificación?___________________________

9) ¿En cuántas hectáreas tiene su cultivo de uchuva?___________ ¿Qué otros cultivos tiene ? ___________________

10) ¿Todos los trabajadores reciben capacitación sobre las BPA? ☐ Sí ☐ No

11) ¿Cuántos trabajadores emplea para su producción de uchuva?______ ¿Cuántos trabajadores pagados? _______

¿Cuántos trabajadores son miembros de la familia? ______ ¿Cuántos de ellos se les paga? __________

12) ¿Cuántos trabajadores emplea solomente para el cultivo?___________ ¿Cuántos emplea solomente para la cosecha?__________________

13) ¿Con qué frecuencia realiza el control de plagas y enfermedades de su cultivo, y quién lo hace? ____________

PRÁCTICAS DEL CULTIVO
¿Cuál utiliza para su cultivo? ☐Semillas ☐ Trasplantes: (edad de las transplantes)? ________________
¿Es el agua analizada por un laboratorio? ☐Sí ☐ No Con que frecuencia?
¿Es el suelo analizada por un laboratorio? ☐Sí ☐ No Con que frecuencia?
¿Qué productos de fertilizantes utiliza? ¿En que concentración? Con qué frecuencia?
¿Cuáles son las plagas primarias? ¿Métodos de control y en que concentraciones?
¿Cuáles son sus principales enfermedades? Métodos de control y concentraciones?
¿Tiene usted un problema significativo con las malezas? ☐Sí ☐No Si hay problema, ¿cuáles son sus métodos de control?
¿Cuál sistema de tutorado que utiliza para su cultivo? ☐ Sistema T ☐ Sistema V ☐ Otro :________________
¿Cuándo comienza la poda? ¿Con qué frecuencia poda?
¿Cuándo cosecha? ¿Con qué frecuencia cosecha?
¿Cuál de las cosas siguientes son problemas frecuentes en su cultivo? ☐ Rajada de fruta ☐ hongos en la fruta ☐ hongos en capacho ☐ daño de insectos ☐ enfermedades ☐deficiencia de nutrientes de las plantas, ¿Cuál ? __________________ ☐ exceso de agua ☐ deficiencia de agua ☐ tamaño pequeño de la fruta ☐ sin tamaño o forma uniforme del fruto ☐ sin color uniforme del fruto
¿Hay un nombre específico de la variedad de la uchuva que utiliza? Si es así, por favor escriba el nombre:
¿Cuál es la duración promedio de su cultivo de uchuva?
Aproximadamente, como cambia sus costos de producción a causa de certificacion? Eligir una, por favor. ☐ningún cambio ☐ bajaron por __10% ___20% ___30% ☐ aumentaron por __10% ___20% ____30%

MANEJO de PRODUCCIÓN		
Por favor, dime dónde han hecho cambios en el manejo de su producción para la certificación de alimento sano para la uchuva: (si no está certificada, por favor conteste acerca de los cambios en los últimos 2 años)		
Sí	**Ámbito de manejo**	**¿Qué ha cambiado y por qué?**
☐	Fuente de agua (source)	
☐	Manejo del agua de riego	
☐	Cantidad de agua de riego	
☐	Análisis del agua de riego	
☐	Cantidad de fertilizantes	
☐	Tipo de fertilizante	
☐	Aplicación de estiércol	
☐	Aplicación de abono/compostaje	
☐	Aplicación de pesticida	
☐	Transporte de productos en finca	
☐	Capacitación de los trabajadores	
☐	Instalaciones para lavar los manos	
☐	Baños para los trabajadores	
☐	Monitorio de trazabilidad	¿Cómo?
☐	Densidad de plantas por hectárea	¿Cuáles son?
☐	Distancia entre plantas y surcos	¿Cuáles son?

CARACTERÍSTICAS AGROECOLOGICAS

Altitud de la finca : _____________ Temperatura promedia:___________ Precipitación anual: _____________

Tipo de suelo: ___________________ Rendimiento promedio (kg por planta): ______________

IMPACTOS DE CERTIFICACIÓN O BUENAS PRÁCTICAS AGRÍCOLAS				
¿Cómo ha afectada la certificación lo siguiente ?	**MAYOR**	**MENOR**	**IGUAL**	**APROX.**
Calidad de producto?				
Precio de venta?				

¿Cómo ha afectada la certificación lo siguiente?	**MAYOR**	**MENOR**	**IGUAL**	**APROX.**
Numeros de los compradores?				
Sus ingresos anuales?				
Sus costos totales de la producción de uchuva?				
Su capacidad para ahorrar dinero?				
Su conocimiento de buenas practicas agricolas (bpa)?				
El conocimiento de los trabajadores sobre buenas practicas ?				
Su volumen de uchuva de buena calidad?				
Su variabilidad de los precios?				
Acceso de los mercados?				

INFORMACIÓN DEL MERCADO
Vías Mercados: ¿A quién le vende su uchuva? ☐ Intermediario ☐ Exportador ☐ Mayorista ☐ Procesador de alimentos ☐ Mercado fresco local ☐ Otro__________
¿Cuál es su precio más alto para uchuva? _____________ Su precio más bajo? ____________
¿Servicios prestados por sus compradores? ☐ BPA ☐ Semillas ☐ Fertilizante ☐ Crédito ☐ Transporte ☐ Los costos de certificación ☐ Nada
¿Qué tipo de contrato que tiene con su compradores? ☐ Oral ☐ Formal/por escrito ☐ Sin contrato
¿Por cuántos años has estado vendiendo uchuva para el comprador actual? _________________ ¿Con qué frecuencia le paga el comprador?________ ¿Cuánto le vende en cada momento? ___kg
¿Mantiene registros de los costos de producción? ☐ Sí ☐ No O los ingresos de la uchuva? ☐ Sí ☐ No

DEMOGRÁFICO	
Género: ☐ Hombre ☐ Mujer Edad: ☐ < 25 ☐ 25-30 ☐31-40 ☐41-50 ☐ > 50 No. de miembros de la familia que viven con usted: ____	¿Qué porcentaje aproximado de su ingreso doméstico total proviene de la venta de uchuva? ☐10 ☐20 ☐30 ☐40 ☐ 50 ☐60 ☐70 ☐80 ☐90 ☐ 100
Nivel de educación completado: ☐ Grado cuarto o menos ☐ Grado octavo o menos ☐ 1-4 años de secundaria ☐ graduado de la universidad ☐ Otro_______________	Total ingresos anuales de la finca: _________pesos Total ingresos anuales de uchuva: _________pesos

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