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PRODUCTION, MARKETING, AND HANDLING PRACTICES TO EXPORT MCINTOSH APPLES TO CENTRAL AMERICAN MARKETS

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PRODUCTION, MARKETING, AND HANDLING PRACTICES TO EXPORT MCINTOSH APPLES TO CENTRAL AMERICAN MARKETS

A Dissertation Presented

by

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DEDICATION

To my children, husband, parents, brothers and sisters, nephews and niece.

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ABSTRACT

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Latin America offers a marketing opportunity for fresh produce, since many countries are entering into global integration and international trade as part of their portfolio of economic growth. However, to take full advantage of these opportunities, many questions associated with the implementation of marketing approaches, fresh produce quality retention, and profitability need be answered before undertaking this business opportunity. When it comes to developing countries such as those in Central America, and in particular - El Salvador, Honduras, and Guatemala - language, culture, technology, competitiveness, regulations, poverty, and other barriers become challenges to enter these markets successfully. In order to better understand opportunities that this region may offer to Massachusetts apples growers, this study examines all aspects of the supply chain related to McIntosh apple consumption in Central America. More specifically, it analyzes the growing, harvesting, storing, packing, transportation, regulatory, and political issues associated with this relationship. McIntosh is an apple

with red and green skin and a distinct juicy crisp flavor of balanced sweetness and tartness. It is the most popular variety in New England and can be produced well only in the northeastern portion of the US.

McIntosh apples have never exported to Central America; thus there is no information available to producers about this potential market to help them make decisions regarding export. This study addressed two research hypotheses: 1) if McIntosh apples are treated appropriately with the best pre-harvest and postharvest practices, no significant changes in fruit quality should be observed in Central American markets, and 2) if Central American consumers accept McIntosh, Massachusetts apples growers could export to Central America profitably. This study was conducted as a research pilot project by exporting a commercial container of McIntosh apples produced in Massachusetts to El Salvador. Two principle experiments were conducted: 1) quality assessment of McIntosh apples trough the supply chain and 2) price determination, which consisted of, collecting all the associated costs to ship a commercial container and the price consumers were willing to pay in El Salvador. This study showed that McIntosh apples can be exported from Massachusetts to Central America. If grown well, treated appropriately with 1-MCP at harvest, and stored at appropriate temperatures and atmospheres prior to shipping, McIntosh apples retain quality even with temperature variations and distribution barriers in the supply chain. In addition, exporting medium size McIntosh apples is profitable.

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INTRODUCTION

In December 2010, marketing research was conducted to evaluate Central American reception of McIntosh apples from Massachusetts. Nearly 800 consumers were surveyed at five stores in El Salvador after being given samples of McIntosh apples produced in Massachusetts. The study showed that consumers particularly liked the sweet-tart flavor, juiciness, and firmness of McIntosh apples. Due to the results of these surveys, some supermarket chains of Central America expressed interest in developing a relationship with apple growers in the Northeastern United States (Alvarado, 2011).

On October 10, 2011, New England Apple Association, US Apple Export Council, UMASS Amherst, and a McIntosh marketing project (funded by a USDA Specialty Crop Block Grant through MDAR) hosted a group of five Central American apple buyers through an apple broker in Massachusetts. Through this McIntosh marketing project, researchers from UMASS Amherst worked with buyers in Guatemala, Honduras and El Salvador in order to introduce this apple cultivar to those countries. This relationship made that in the fall of 2011, the largest international supermarket chain in Central America requested commercial containers of McIntosh apples to be sent to El Salvador and Guatemala in order to present this variety to those markets. However, the shipment did not take place due to problems with supply and the uncertainty expressed by growers, shippers, and buyers.

Since apple consumption is increasing in developing countries, growers and wholesalers need to know more about developing those countries' marketing behavior. This research proposed the development of efficient marketing methods that take

advantage of the opportunity to introduce McIntosh into Latin American markets. In addition, this study evaluated the production, marketing, and handling practices needed to export McIntosh Apples from Massachusetts to Central America. Since McIntosh apples have never been exported to Central America commercially, Massachusetts growers do not have market information necessary to make decisions regarding export. Furthermore, because Central American retail markets have never sold McIntosh Apples to their clients, McIntosh will be a completely new variety for them, as well.

For that reason, the major goal of this study was to enhance the opportunities to market McIntosh apples in Latin America. This included determining price for the long-term success of exporting McIntosh apples to Central American markets. Determination of pricing was needed to evaluate the costs of sending McIntosh from New England to Central America, as well as to understand the market structure and determine how apples sales are likely to respond to price. Since apple quality is one of the major concerns in exporting McIntosh to Central America, this study also evaluated McIntosh fruit quality-retention in the value chain from Massachusetts to Central America. This postharvest study focused on the handling practices used in export logistics, transportation, distribution, and retail, and how these practices affect the quality at the final destination. In order to conduct this analysis, a commercial container of McIntosh apples was shipped to the primary importers in Central America to assess costs, quality and consumer sensitivity to prices and preference.

This study has two hypotheses: 1) since McIntosh apples have been treated appropriately with the best pre-harvest and postharvest technology, no significant changes in the quality of McIntosh apples should be observed in Central American

markets, and 2) if McIntosh is accepted by Central American consumers, Massachusetts apples growers could export to Central America profitably.

CHAPTER I

LITERATURE REVIEW: PRODUCTION AND POSHARVEST PRACTICES ON APPLES FRUITS

1.1 Biological considerations on Postharvest practices

1.1.1 Respiration, processes, and climacteric

In Merriam Webster dictionary (n.d.), respiration is defined as a physical process by which an organism supplies its cells and tissues with the oxygen needed to metabolize and release the carbon dioxide produced in energy-producing reactions. According to Han, (2013) Plant physiologists define respiration as any of the various energy-yielding oxidative reactions in living matter. Han claims that the key word in both definitions is energy. It also well known that respiration is a vital process for living, breaking down organic matters and liberating energy, which is used for chemical reactions in cells; however, much of the energy is lost through heat. Kays and Paull (2004) explain the respiration process is divided into three pathways: glycolysis, citric acid cycle, and electron transport system. They also describe that glycolysis splits glucose molecules; the citric acid cycle takes place in the presence of oxygen and transfers energy from the carbon bonds to energy compounds. Kays and Paull (2004) affirm that in the electron transport system, the energy captured from the original glucose molecule is used to convert ADP to ATP, the primary energy currency in the cell. As it can be seen, the presence of oxygen is one of the factors that affect the respiration pathway. Due this fact, the respiration rate is largely determined by temperature. Hence, to slow respiration and enhance the longevity of harvested products, the heat present at harvest and postharvest

needs to be removed. When heat is not removed, it will short the postharvest life of the produce.

The respiration process not only provides energy for cells to continue to function, it is a precursor for many plant's reproduction. Some of them are directly linked to the quality of the produce. Generally speaking, the postharvest life of produce is inversely related to respiration rate. This means that if the produce has a high respiration rate, then it is expected to have a shorter postharvest life (rapidly senescing tissue). The produce that has a low respiration rate will have a longer postharvest life (slowly senescing tissue). For example, apples, citrus, grapes have a low respiration rate that ranges from 5 – 10 mg CO2/Kg-hr while leafy vegetables and flowers have a high respiration rate that ranges from 40 to 60 mg CO2/Kg-hr. (Kader, Morris, and Cantwell, 2001).

In addition, some edible fruits are classified according their respiratory behavior while ripening. Fruits such as tomato, mango, banana and apples, show a pronounced increase in respiration, coincident with ripening. These fruits are called climacteric, and it is during this pronounced increase in respiration that all the changes characteristic of ripening occur. However, the non-climacteric fruits exhibit most of the ripening changes slowly (Wills, Lee, Graham, McGlasson, and Hall, 1981). The importance of understanding the biological considerations on postharvest practices are critical to determine the postharvest system to use according to each fresh produce in particular.

1.1.2 Ethylene

In addition to the respiration rate on fruits, some climacteric and non-climacteric fruits are differentiated by their pattern of ethylene production during ripening (Kays and Paull, 2004). Ethylene is known as a major plant growth regulator and ripening hormone

in climacteric fruits, such as apple, apricot, avocado, banana, mango and other fruits. Coincident with ripening, climacteric fruits produce much larger amounts of ethylene than non-climacteric fruits (Wills, Lee, Graham, McGlasson, and Hall, 1981). In addition, ethylene will initiate the ripening of climacteric fruits and will cause some ripening-like changes in non-climacteric fruits similar to those in senescing tissue. Its importance in apples is due to its detrimental effect on the apples' postharvest quality (Wills, Lee, Graham, McGlasson, and Hall, 1981).

Considerable research has been conducted using several approaches to understand what factors affect ethylene production and ethylene action. Some of these factors are the species and cultivars, physiological age at harvest, temperature, atmospheric composition, other hormones, and stresses such us physical stress and diseases.

1.1.2.1 Protection against Ethylene

There are many different ways to protect a produce against ethylene damage. The most used method is to avoid it, which means not to mix ethylene producing fruits with ethylene sensitive commodities. Another method is to inhibit the ethylene synthesis or the action of the ethylene. To inhibit the ethylene synthesis there are some commercial products for fruits, for example, Retain, which contain AVG (aminoethoxyvinyl glycine) to inhibit the ethylene synthesis. To inhibit the ethylene action at receptor sites, inhibitors have been studied for many years. For example, CO_2 is a competitive inhibitor at ethylene binding sites, which means that when CO_2 is bound to the binding site ethylene will not be able to bind, and the subsequent action of the ethylene will not happen (Wills, Lee, Graham, McGlasson, and Hall, 1981). However, according to some researchers CO_2 can also be damaged for some produce.

In addition to CO_2 there are other inhibitors of ethylene action. For apples, one of the most currently used inhibitors of the ethylene action in the industry is 1-methylcyclopropene (1-MCP). 1-MCP is a gas that was discovered by Dr. Ed Sisler of North Carolina State University. Structurally 1-MCP is very similar to ethylene and because of its structural similarity, 1-MCP attaches to the ethylene binding sites (Serek, Tamari, Sisler, and Borochov, 1995). Researchers have shown that plant cells treated with 1-MCP do not begin the senescence process. The net effect of the 1-MCP is protection from ethylene damage and, therefore, an increase in postharvest life.

1.1.2.1.1 Use of 1-MCP on Fruits

Most of the research in the use of the 1-MCP (commercial name SmartFresh™) has been conducted on apples. Apples are climacteric fruits that produce ethylene. Due to this, the use of 1-MCP on apples is one of the most important technologies used for the apple industry to retain firmness and to have a longer shelf life on apples. However, many researchers have shown that the response of apples to 1-MCP is dependent on a number of variables such as application technique, exposure time, exposure temperature, cultivar, and the maturity stage (Watkins, 2006). However, to obtain consist results from 1-MCP experts recommend to control all these factors carefully. For most apples, the fruit needs to be treated during the first 2.5 days of the onset of the climacteric. When treated during this time, the fruit will revert back to pre-climacteric. This will allow the fruit to be in storage for an extended period of time. Beyond about 2.5 days of the onset of the climacteric, 1-MCP only suppresses ripening by suppressing the ethylene production, but not revert back to pre-climacteric. In addition, another aspect of the 1-MCP effect on apples is the retention of flesh firmness (Warner, 2003)

As an apple enters the climacteric rise, it softens and becomes mealy. Commercially, refrigerated and controlled atmosphere storage are used to minimize the impact of ethylene on senescence and on the loss of firmness of the fruit. Use of 1-MCP prevents the action of the ethylene (Serek, M. 1995). In addition, Jung, S.-K.K. (2009) claim that apples treated with 1-MCP can tolerate temperature mismanagement much better than untreated apples. This mismanagement is a common postharvest problem. However, treatment of 1-MCP has also some negative impacts on the quality of apples. For example, flavor is affected, because ethylene is required for the synthesis of the volatile compounds which are related to aroma on apples. Some researchers show that 1-MCP also increases pathological problems but decreases superficial scald on apples (Watkins, 2006).

As this point, apples are the only fruit for which 1-MCP is labeled for the use commercially in the USA. Researchers have conducted many experiments in others crops, and with time, it likely will be labeled for other crops (Watkins, 2006). However, in many other countries 1-MCP is approved for use in many edible crops (Han, 2013).

1.2 Handling techniques and practices

1.2.1 Temperature

Postharvest physiologists recommend that when trying to control a problem always begin with temperature. They also suggest that when temperature alone is insufficient in controlling the problem, then it is suggested to go to another factor in conjunction with the optimal temperature for handling a particular produce. Temperature is extremely important since it regulates the rates of all biological reactions including the wide variety of reactions within senescence (Wills, Lee, Graham, McGlasson, and Hall,

1981). Reduced temperature affects the loss of produce due to pathogens by slowing pathogen metabolism and growth rate and by delaying produce senescence and, therefore, the loss of resistance to pathogens (Kays and Paull, 2004). Finally the importance of temperature control depends on two factors: perishability of the commodity and how much postharvest life is needed before the produce will be consumed (Kader, 2002).

1.2.2 Humidity and water loss

In addition to temperature, many studies have been conducted in order to know how humidity affects postharvest moisture loss from commodities. It is well known that relative humidity (RH) is the ratio of the quantity of water vapor in the atmosphere to the maximum amount possible at that temperature and pressure. This concept is important for postharvest purposes due to the potential of increasing water content in the air and reduce water loss from commodities (Wills, Lee, Graham, McGlasson, and Hall, 1981). Another important concept to understand is Vapor Pressure Deficit (VPD), which is the difference in vapor pressure between the saturated vapor pressure in the tissue and the actual vapor pressure in the atmosphere (Kays and Paull, 2004). Resulting that the amount of moisture loss from produce is directly proportional to the VPD. However, researchers claim that moisture loss is much greater when produce is not cooled before being refrigerated (Kader, Morris, and Cantwell, 2001). This is the main reason behind the use of many different pre-cooling methods and why produce handlers are advised to quickly cool down their produce after it is harvested. To reduce moisture loss, both temperatures of the commodity and the temperature and the RH of the surrounding air should be controlled.

1.2.2.1 Impact of moisture loss

All moisture loss results in loss of weight, volume, and sellable product. (Han, 2013) claims that if wilting and shriveling occur and causes loss of sales appeal, income potential literally evaporates. In general, 2% water loss causes wilting of vegetables and shriveling of fruits (Kader, 2002). However, weight loss is often underestimated; in many situations when the produce is mishandled the water loss could be as high as 15% (Kays & Paull, 2004). Minimum acceptable loss of water from selected crops is between 5 and 7% (Kays and Paull, 2004). Therefore, the impact of water loss is a major factor in postharvest losses, and producers should try everything possible to minimize water loss from produce. The primary factors affecting rate of moisture loss are species or cultivar, VPD caused by changes in temperature and RH, surface-to-volume ratio, and air movement (Kays and Paull, 2004).

There is a loss of crispness and rigidity when a fruit loses water. There are different methods to reduce water loss such as handling techniques, RH in the refrigerated system, use of plastic films, waxing, seal pack, and the jacketed storage (Wills, Lee, Graham, McGlasson, and Hall, 1981). The primary factor reducing water loss is the care and speed of bringing the produce to the optimum storage temperature. Rough handling would increase physical damage and water loss through the ruptured epidermis. Tardiness increases the time produce is exposed to high level of VPD and results in high water loss (Kays and Paull, 2004). The second factor affecting water loss is the RH in the refrigerated system. High RH is desirable in the storage room, especially if the commodity will be storage for a long time (Kays and Paull, 2004). In most refrigeration systems, heat is removed from the air by the cooling coil, which reduces the

relative humidity of the storage. The third method that can reduce water loss is the use of plastic film, which impedes movement of moisture away from the produce (Kader, 2002). Waxing supplements natural coating and increases resistance to gas exchange, including water vapor (Kader A. A., 2002). Seal packs control moisture without modifying the atmosphere (Kader, 2002). Another methods is the jacketed storage that was developed for long-term storage of root crops. The jacketed storage minimizes heat infiltration and reduces humidity in the circulation air (Kader, 2002).

1.2.3 Modified atmospheres and controlled atmosphere in the postharvest period

1.2.3.1 Modified atmosphere (MA)

Studies show that the atmosphere contains approximately 21% O_2 and 79% N_2 and 0.037 CO_2 (Wills, Lee, Graham, McGlasson, and Hall, 1981). Modified Atmosphere (MA) is a technique that reduce O_2 and increase CO_2 around and in the produce. To conduct this process researchers have developed different methods that are mainly used in three types of commodities: fruits and vegetables, meat and meat products, and seafood. Modifying the atmosphere in these commodities can be done using several procedures such as 'Modified Atmosphere Packing' (MAP), 'Equilibrium Modified Atmosphere Packing' (EMAP), and 'Modified Atmosphere/Modified Humidity Atmosphere' (MA/MH). By performing these technologies, a balance of gases is created inside the packaging. Consequently, the atmosphere will result in lowering respiration rate that cannot be achieved by temperature alone (Kays and Paull, 2004). Studies also show that the respiration slowly declines as O_2 decreases from 21% to 1%, and as CO_2 level increases (Kader, Morris, and Cantwell, 2001). In fruits and vegetables studies indicate that MA has the potential to delay the onset and progress of fruit ripening, delay

senescence in vegetables and flowers, delay onset of symptoms of physiological disorders, reduce decay, control insects, and retard wound healing (Kader, 2002). Consequently, MA can increase postharvest life of produce when it is used properly. However, studies also demonstrate that MA can initiate or intensify some physiological disorders such us internal and external browning (Wills, Lee, Graham, McGlasson, and Hall, 1981), irregular ripening, and also can increase susceptibility of decay, and other harmful effects (Kader, Morris, and Cantwell, 2001).

1.2.3.2 Controlled atmosphere (CA)

The main difference between MA and CA is that CA is conducted by precisely controlling the composition of the atmosphere. In addition, CA is also known as reduced O_2 storage, low O_2 storage, elevated CO_2 storage, high CO_2 storage and nitrogen storage. Experts always recommend that either CA or MA should be used as a supplement, not substitute, for appropriate maintenance of optimum temperature and RH for a given commodity. These methods can be used for transport, temporary storage, and long-term storage of commodities (Kader, Morris, and Cantwell, 2001). Other important requirements, when using CA, are to have an air right room, a sealed system, refrigeration capacity, monitoring systems for O_2 and CO_2, system to add O2, and system to remove CO2 (Kader A. A., 2002). One of the benefits to using CA is that it can be continuously used for several months for durable produce. Some wholesalers claim that it is very expensive but is extremely effective on apples and some cultivars can be stored for more than 12 months (Kader, Morris, & Cantwell, 2001). Studies show that originally, 3% O_2 and 5% CO_2 were used (Smith, 1963), but better equipment has

allowed 0.8-1.5% O_2 and 1% CO_2 to be used regularly for some varieties (Kader, Morris, and Cantwell, 2001).

1.3 The importance of firmness on apples

Much of the current work on fruits has focused on how to maintain high quality fruits for consumers. In particular, one of the most important measurements that determine the quality for apples is firmness or texture (Johnston, Errol, and Hertog, 2002). The next part of this literature review presents those factors which affect firmness or softening on apples and the relative influences of pre-harvest, at-harvest, and postharvest factors on this process.

1.3.1 Pre-harvest factors affecting firmness of apples

Fruit from different orchards often differs in firmness after storage, despite being stored in similar conditions. This variation in quality is the result of differences in storage potential at harvest, that in turn are determined by the collective impact of several pre-harvest and at-harvest factors (Bramlage, 1993).

Two main approaches have been undertaken to determine the impact of pre-harvest factors on the firmness of apples. The first is the systematic process of changing one variable in the orchard and assessing the consequent quality at harvest and after storage (Johnson, 1994). The second is by collecting fruit from orchards with a range of pre-harvest practices and analyzing attributes of the fruit at harvest that indicate storage potential (Bramlage, 1993) (Johnson, 1994). These pre-harvest factors that affect apple quality before and after storage include climatic factors such as light intensity, temperature, and rainfall (Greene, 2010). Cultural factors such as mineral nutrition, timing, and the extent of thinning that affects crop load, orchard floor management,

irrigation, tree management, and use of growth regulators; and genetic factors that involve choice of cultivar or clone, rootstocks, and interstocks (Bramlage, 1993).

1.3.2 At-harvest factors affecting firmness of apples

Researchers have studied that the two major factors influencing postharvest softening of apples at harvest are maturity and fruit size. Maturity is defined as the stage of development at which horticultural crops are harvested to meet consumer requirements (Watada, Herber, Kader, Romani, and Staby, 1984). The different stages of development are growth, maturation, ripening, and senescence. Apple fruits are considered horticultural mature during maturation and the early stages of ripening (Watada, Herber, Kader, Romani, and Staby, 1984). With regards to texture, apples harvested at a later stage of maturity are often softer at harvest and after storage than apples picked less mature (Ingle, D'Souza, and Townsend, 2000). Regarding to size, generally is accepted that larger fruits are softer than smaller fruits both at harvest and after storage (Harker, Redgwell, Hallet, and Murray, 1997), as smaller fruits usually have more cell wall material per unit volume, and therefore should have stronger tissue than larger fruits.

1.3.3 Postharvest factors affecting firmness of apples

The main postharvest factors that influence apple softening include temperature, relative humidity (RH), calcium treatment, atmosphere, and ethylene production (Johnston, Errol, and Hertog, 2002). In particular, temperature strongly influences the postharvest life of apple fruit, researchers recommend storing apples at 0-3°C. However, the temperature used depending on cultivar sensitivity to chilling injury. Despite 0-3 °C being the optimum postharvest temperature for slowing loss of firmness and many other aspects of quality loss, apples are often exposed to non-optimal temperatures during

grading, packing, distribution, ship loading and unloading, and in retail outlets while on display (Johnston et al., 2002).

Relating to relative humidity, studies suggest that the optimum RH for apples to keep firmness is from 90% to 95%. Regarding calcium treatments, studies show that calcium maintains the texture of apples by reducing ripening and increasing tissue rigidity, thus improving the storage performance of many fruits (Pooviaih, Glenn, and Reddy, 1988).

In terms of market life for firmness, the use of controlled atmosphere methods (CA) is the most used system, this method is cultivar dependent, and influenced by the O_2 and CO_2 concentrations, time between harvest and establishment of CA conditions, storage temperature, fruit maturity, and exogenous ethylene concentration in store (Kader, 2002).

1.4 Physiological disorders on apples

Apple fruit has a wide variety of potential physiological disorders. However, susceptibility varies by cultivar, pre-harvest factors, and postharvest conditions (Lidster, 1990). Lidster also claims that disorders can be considered in three categories. First, watercore, which is associated with advancing fruit maturity and low night temperatures prior to harvest (Marlow & Loescher, 1984). Second, bitter pit, which is directly related to calcium deficiency in the tissue beneath the fruit epidermis (Ferguson and Watkins, 1989). Other important disorders that develop only during storage are senescent breakdown (calcium deficiency), brown core (chilling injury), and damage caused by O_2 concentrations too low or CO_2 concentrations too high (Meheriuk, Prange, Lidster, and Porritt, 1994).

1.5 Supply chain related to McIntosh apple consumption

As it was mentioned above, all practices during production, harvesting, and packing, affect the apple quality and consequently profits. Therefore, the production, handling, and marketing practices through the supply chain have an important effect on profits. The goal of this section is to review some practices suggested by experts and the apple industry along the supply chain related to McIntosh apple handling. Specifically, the growing, harvesting, storing, packing, and transportation associated with this relationship. This review will outline current knowledge on these best-management-practices for growers, transporters, retailers, and consumers in order to have sustainable marketing of apples.

1.5.1 Apple quality

First of all, it is important how apple quality is defined. In the food marketing system, quality is a term used to determine the produce acceptance; this term consists of a combination of visual appearance, texture, and flavor; each commodity has its own quality standards which are given for each produce in particular. For apples, according to the USA apple industry standards, visual appearance is skin-color dependent, which varies by cultivar among green, yellow, red, and other colors. In addition, high quality apples must be free from blemishes caused by physically induced damage, such as bruising or stem-punctures, and by physiological and pathological disorders. Furthermore, another constituent of quality is the texture. Consumers' demand apples that are crisp, crunchy, and firm. In addition to texture, flavor from sweetness and acidity varies by cultivar (USDA, 2002). Those aspects determine the apple quality and the final price in the apple market industry.

1.5.1.1 Pre-harvest practices on McIntosh apples

Through the growing season, insect and disease pests can influence fruit quality. To have the best McIntosh, growers work continually to reduce pest damage through the use of integrated pest management. In addition, orchardists control pest damage by working with, rather than against, nature (Greene, 2010). Growers use an understanding of pest and disease life cycles, scouting of the incidence of pest problems, and a multitude of weather data and accurate pest models to determine the best times to spray so that needed chemicals are used efficiently (Greene, 2010).

Another important practice is Calcium treatment. Calcium is an important nutrient element, which can dramatically affect apple quality after harvest. According to Autio, Bramlage (2001) calcium deficiency expresses itself in the form of bitter pit and cork spot, which develop during the growing season, and senescent breakdown, which forms during and after storage. Consequently, growers use calcium treatments during the growing season to avoid problems during the storage season. Autio and Bramlage also found that applications must begin three weeks after petal fall and continue at two weeks intervals until harvest. They also claims that the must substantial benefit to use calcium treatment is fruit storability and reduction of losses to storage disorders. In addition, Meheriuk, M., (1936) that senescent breakdown is favored by light crops, large fruit, advanced fruit maturity, cool weather in the latter part of growing. Greene (2010) also claims that high levels of humidity and CO_2 in the storage atmosphere favor senescent breakdown. These practices during the growing season are determinants in order to have a high quality apple.

1.5.1.2 Practices on apples at-harvest

As it is well known, apples are a climacteric fruit and a multitude of changes occur from a month before harvest, through harvest, and during several months of cold storage. These changes are associated with ripening (Greene, 2010). In addition climacteric fruits have high respiration rate during ripening; all the enzymes and everything that a fruit needs to ripen happens during this process. Throughout this ripening process ethylene increases dramatically.

One of the most important practices suggested by experts is that growers must harvest apples at the optimal time. For example, if growers harvest immature fruit, they will maintain firmness in storage but will have less flavor, less color, and smaller size and greater incidence of some storage disorders (superficial scald, brown core, and core flush) than if harvested later. On the other hand, if apples are harvested when over mature, fruit eating quality may be good at harvest, but they often experience more pre-harvest drop, apples will be softer and may develop more of some storage disorders (senescent breakdown and water core) than if picked earlier (Green, 2010).

According to Washington State University - Tree Fruit Research & Extension Center (1994) the timing of harvest must be based on the postharvest requirements, which include the intended length of storage and shipment. Kupferman, (1994) from this extension center also claims that apples shipped great distances or stored for a long time must be harvested at a less mature stage than those consumed immediately after harvest. There are several methods available to help determine when best to harvest apples (Table 1) (Greene, 2010). One of the easiest and most used methods is to monitor changes in starch with iodine staining.

1.5.1.3 Postharvest practices on apples

According to Kader (2002), during the time between harvest and consumption, temperature control is the most important practice in maintaining apple quality; keeping apples cool will slow down the changes associated with ripening and give growers more time to market their apples. The lowest safe temperature recommended when apples are going to be stored for a long term period is from 2 °C to 3 °C (Kader, 2002).

Experts also recommend storing McIntosh Apples in controlled atmosphere (CA) storage to obtain better results (Carlson, 2012). The principle of this method is to slow respiration by lowering the temperature to near 0°C. By reducing the temperature the biochemical changes on apples will be blocked. In apples, the range to decrease oxygen is from 20 to 2 - 4%. This in effect provides enough O2 so that the apples stay alive, but respiration and the processes of senescence (including the production of ethylene) are slowed due to the lack of O2. Increasing CO2 from 0.03% to 3-5% also slows respiration because of the overabundance of CO2, and at these concentrations, CO2 also inhibits ethylene action (Kader, Morris, and Cantwell, 2001). Growers and experts suggest the use of 1-MCP combined with CA for apples to be stored long-term. The efficacy of 1-MCP is however, affected dramatically by cultivar and storage conditions, and successful commercial development requires a complete understanding of these relationship (Watkins, 2006).

In the same way, USDA (2004) recommends another practice to ensure an adequate level of storage and packaging. This practice is to educate people working in the packing house. In addition, USDA (2004) also recommends that workers must be very careful to accurately separate each lot according to picking date and orchard block,

classifying fruits with similar characteristics. Furthermore, packing must be careful planned to provide uniformity and consistency from box to box, increasing consumer confidence in the quality (USAID, 1999). Finally during the packing process, growers must follow the grade standards allowed by the USA: (U.S Extra Fancy, U.S Fancy, and U.S No.1) based first on color, but also on freedom from decay, disorders and blemishes, as well as firmness of fruit (USDA, 2004)

The recommended conditions for commercial storage of apples are -1- 4°C and 90-95% RH, depending upon variety. For McIntosh, the following conditions give the best quality after storage: treat with 1-MCP and store at 2.5% O2, 2.5% CO2, 0°C (USDA, 2004). Under these conditions, good quality fruit should be able to be stored for 5-7 months (Watkins and Miller, 2004).

1.5.1.4 Transportation practices on fresh apples

USAID, 1999 recommends some practices when transporting fresh produce. One of the most important practices during transportation that they suggest is temperature management, especially critical for long-distance transport. In addition, USAID, 1999 also suggests using proper air flow to ensure that the loads stay cool handling, and storage at proper relative humidity (RH). Furthermore, Kitinoja and Kader (2002) claims that “transport vehicles should be well insulated to maintain cool environments for pre-cooled commodities”. Moreover, they also recommends that loads should be placed properly inside the trailer, away from the side walls and back door of the trailers. Experts also recommend transporting during night hours to avoid warm weather, since deterioration will increase as temperature increase.

1.5.1.5 Retailers and Distributors

Temperature is strictly important in the distributor and retailers as it is for all the supply chain participants. These participants of the supply channel must store the apples at a temperature between 2 °C and 4 °C. The relative humidity must be maintained between 90 and 100%. In addition, other merchandising practices for retailers and distributors are recommended such as not to overlap more than 7 boxes of 42 pounds to avoid compression bruising, handle apples carefully and always arrange them by hand. In addition, keeping damaged or bruised apples off historical shelf, not to spray water over the apples due to this will cause loss of flavor and crunchy texture, and other.

1.5.1.6 Consumers

In the same way, the practices for consumer are very similar that for retailers: however, it is strongly suggested storing apples in the refrigerator when possible, at least. If there is not a refrigerator, consumer should sure the apples are placed in cool areas.

1.6 Conclusions

First, during the growing season, apples produced under optimum sustainable practices will have a longer storage life. These sustainable practices include paying attention to tree nutrition, particularly for those elements that influence the storage life of the fruit. These nutrients include nitrogen, calcium, potassium, magnesium, phosphorus, and boron. However, calcium is the nutrient element which can most dramatically affect apple quality after harvest (Autio & Bramlage (2001). Similarly, apples must be harvested when they are physiologically mature but not fully ripe. In addition, hand picking apples and cooling the same day is another sustainable practice recommended (Weis, 1983).

For long-term storage of McIntosh apples, controlled atmosphere storage and treatment with 1-MCP are recommended. However, to treat apples with 1-MCP growers must follow the application protocol for each variety in particular. Experts have also found that growers must cool apples as soon as possible when using 1-MCP and achieve the desired atmosphere in order to ma maintain good quality in storage. Studies also show that to have the highest effectiveness on apples treated with 1-MCP the O2 and CO2 levels must be adjusted as soon as possible to have adequate results in controlled atmosphere storage (Watkins and Miller, 2004).

All participants of the cold chain must store McIntosh apples at a temperature of between 2 °C and 4 °C. The relative humidity must be maintained between 90 and 100%. Finally, for consumers it is suggested to store the apples in the refrigerator when possible or to place apples in cool areas. In other words, high quality is a result of using several production and handling practices from production to consumption.

1.7 Tables and Figures

Table 1.1: Method to evaluate when harvesting apples

Methods	Description
1) Respiration rate:	Increase in respiration is an excellent measurement to determine when ripening begins, but it is not practical for the grower.
2) Internal ethylene	As with respiration, ethylene concentration is an excellent way to determine when ripening begins, but it is not practical for the grower.
3) Red color:	Anthocyanins become more evident with cooler weather and the breakdown of chlorophyll. This red color is an indicator, however quite variable.
4) Chlorophyll and carotenes + xanthophyll.	Especially useful for yellow and green varieties
5) Flesh firmness:	This change could vary from year to year. Growers should keep recordings. It gives an idea of quality, but not very definite, however, it is good to determine length of storage time.
6) Soluble solids:	Soluble solids increase because the starches break down into sugars.
7) Starches:	Starch stains blue/black when treated with a solution of iodine and potassium iodide. Starch loss is seen by a change in the pattern of staining when the cut cross-section is treated. Charts are used to quantify the change and track ripening. A McIntosh-specific chart has a scale from 1 to 9, with 1 being complete staining and 9 having no staining: 1, 2, 3 means immature, 4, 5, 6 means mature, and 7, 8, 9 means over mature. This method is pretty useful to determine harvest.
8) Volatiles:	The apple's smell can indicate the degree of ripeness. This indicator is great for direct sales.
9) Wax:	When the fruit feels very waxy, it often if overripe.
10) Bloom and variety:	Optimal harvest is somewhat determined by bloom, but not very predictably. The timing of ripening of each variety is reasonably consistent and gives a general time of harvest.

Source: Greene 2011. Deciduous Fruits Lecture, 2011, University of Massachusetts, Amherst

CHAPTER II

LITERATURE REVIEW PART II

LITERATURE REVIEW: INTERNATIONAL MARKETING PRACTICES

2.1 Introduction

This is an applied research pilot project that furthers the export of McIntosh apples from Massachusetts to Central, and Latin America Region. Brenes (2013) states that Latin American is an emerging market that has a considerable number of potential consumers, makes it an attractive option for exporting agricultural products. For that reason, the main objective of this applied research pilot project is to expand the research agenda by examining the exportation possibilities in sectors and geographical areas which have been underrepresented in previous academic marketing research studies. This is the case of the Massachusetts Apples Industry and the Central America market group.

In addition to that interest, this research is a second phase of the Market Analysis for Massachusetts for Central America Markets, which was conducted in 2011 by the University of Massachusetts. It concluded that there are opportunities for McIntosh apples in Central American (Alvarado, 2011). Thus, this pilot project was developed to further understand the profitability of exporting McIntosh as a viable marketing option for growers. Given the particularity of the first study, it had very few results about the marketing and exporting practices for McIntosh apples from Massachusetts to Central America. Consequently, this research is exploratory and innovative because of the following reasons: 1) McIntosh is a new variety in the Central America marketplace; 2) At the present time, Massachusetts Growers have not exported any variety of apples from

Massachusetts to Central America, for this reason no cost or logistical information related to exporting from apples from Massachusetts to Central America exist. 3) Almost no information exists to determine the price at which the McIntosh apples could be sold to Central America.

With the purposes described above, this literature review aims to provide a comprehensive understanding of the international market environment when exporting is undertaken. The main sections are organized as follows. Section 1 describes the generic international marketing practices and its environment. Section 2 presents the generic export processes.

2.2 Dimensions for International Marketing Practices

Various authors define International marketing as the performance of all activities between production and consumption, which imply plan, price, promotion, and the direct flow of goods, services and information to consumers or user in more than one nation for a profit (Isobel and Lowe, 2008; Cateora and Graham, 2007; Seperich and Beierlein, 1994). Cateora and Graham (2007) also state that the main difference between domestic and international marketing is that part of the activities take place in a foreign country. Therefore, international marketing is complex and diverse. Cateora and Graham (2007) also claim that this complexity could be due to the several unknown problems and uncontrollable factors than any other business environment. Some of these unfamiliar problems could be competition, legal restraints, government control, weather, consumers' needs, political problems, cultural forces, geographic infrastructure, distribution channels, and level of technology, competitive forces, and economic forces.

On the other hand, aside from cultural differences, marketing concepts, processes, and principles, are universally applicable and the same domestically and internationally. A marketer's task is the same whether doing business in Amherst, Honduras or any other place around the world. Alternatively, Banalieva et al. (2013) consider that the key to success in international marketing is to be able to identify and understand the factors that affect each case in particular. These factors are mentioned by many researchers and include the following: 1) cultural factors, which are cultural differences, and especially language differences; 2) legal environment factors, which involve 'rules of the game' for business activity such us local domestic law, international law and domestic law in the home country; and 3) economic environment factors, which involve a world level in terms of the world trade integration infrastructure, such as world institutions and trade agreements developed to foster international trade, at a regional level in terms of regional trade integration, and at a country market level. Among other factors are the developed economies, currency risks, politics, technology, and security (Brouthers, 2013).

While doing business in a different country, there are also a number of regulations and procedures to take into account that are part of the international business environment. Some of them are discussed in the following sections.

2.3 International Business Environment

2.3.1 Global Institutions

In history, there have been significant developments that have marked the international business evolution. Some of the most mentioned developments in the literature are, for example, 'World War I' that occurred in 1914 and involved many countries in negotiations for different goods. Another important event that occurred the

same year was the completion of the Panama Canal, which made trade easier and faster. After many discoveries in transportation and communications media, technology, productivity and other no less important inventions, countries were increasing their share of business in the world. In addition to these events, throughout history humans have developed and created institutions and laws that regulate international trade. One of the first moves toward international cooperation among trading countries was manifest in the Negotiation of the General Agreement on Tariffs and Trade (GATT). This negotiation required reduction of tariffs and other barriers to trade. However, this movement was not successful and brought economic disaster following World War I. For that reason, the first 117 members of the GATT established the World Trade Organization, WTO that moved international business into a new era of free trade. The WTO was ratified in 1995, by 2000 more than 130 members accounted for over 90% of world trade. However, the WTO still requires some traditional nontariff barriers to trade which include technology and the need for standards (safety, health, and so on). The WTO advocates worldwide harmonization of product standards.

Other important institutions that regulate international trade are the International Monetary Fund and World Bank Group. The International Monetary Fund and the World Bank group, institutions created to assist countries in becoming and remaining economically viable.

2.3.2 Marketing and Economic Development

Another important point to consider when doing international marketing in a foreign country is the economic level of the country, which some economists declare that is the single most important environmental element to which the international marketer

must adjust the marketing task. Alan, 2005; Witkowski, (2005) state that, in developing countries, the level of the economy affects the performance of the business on its entire marketing system, especially for its distribution system, training staff, and demand for goods (Parsley, 2004). Other researchers state that international marketing success is mostly affected by the country's stage of economic development based on its level of industrialization (Cateora and Graham, 2007). They group countries in three categories: 1) More-developed countries, 2) Less-developed countries, 3) Least-developed countries. Many of the Less-developed countries are in Latin America, which are industrially developing countries just entering world trade.

2.3.3 International Commitment and Planning Process

According to the American Marketing Association, "International Marketing is a multinational process of planning and execution to price, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual or organizational goals". This association also states that the junction of these elements is the result of internationalization. Many authors say that international marketing is an extension of exporting where the marketing mix is simply adapted in some way to track the differences in consumers. However, Isobel and Lowe (2008) said that international marketing could be divided as: 1) export marketing, in which case the firm markets its goods or services across national or political boundary; 2) international marketing, where the marketing activities of an organization includes activities, interests, or operations in more than one, and 3) global marketing, which focuses on the selection and exploration of global marketing opportunities and move resources around the globe with the objective of archiving a global competitive advantage and use available international resources.

Cateora and Graham (2007) also say that whether a company is marketing in several countries or entering a foreign market, planning is the most important task. In order to have a marketing plan to enter into new markets the following phases are the most recommended by them: 1) Preliminary analysis, which is matching company and country needs; 2) Adapting Marketing Mix to target markets; 3) Developing the marketing plan; and 4) Implementation and control. Once firms have as part of their goal to do international marketing, they have to analyze the market-entry strategy.

2.3.4 Exporting

According to Cateora and Graham (2007) exporting is one of the strategies mostly used to conduct marketing internationally. Exporting can be either direct or indirect; it depends on the marketing channels used. With direct exporting, the company sells to a costumer in another country. Indirect exporting usually means that the company sells to a buyer (importer and distributor) in the home country, who in turns exports the product. Customers include large retailers such as Wal-Mart or other huge supermarket chains, wholesale supply houses, and other that buy to supply customers abroad. Experts suggest when entering a new foreign country to develop a direct exporting channel to minimized costs and financial risks (Banalieva et al., 2013)

Exporting is an integral part of all international business, whether the company is large or small, or whether it markets in one or more countries. Most countries control the movement of goods crossing their borders, leaving (exports) and entering (imports). Export and import documents, tariffs, quotas, and other barriers to the free flow of goods between countries are requirements that must be met by the exporter, the importer, or both. The exporting process includes the licenses and documentation necessary to leave

the country, an international carrier to transport the goods, and the fulfillment of the import requirements necessary to get the shipment legally into another country.

2.3.4.1 Terms of Sale

The Spadaro International Services website presents an amply explanation about the terms of sale; terms of sale mean how buyers and sellers divide risks and obligations. When the exporter negotiates an order with the overseas buyer, decisions have to be made as to the use of a particular sales method such as FOB (Free on Board) or CIF (Cost, Insurance and Freight). Experts claim that the most frequently used international trade terms include the following. 1) CIF (Cost, Insurance, Freight + destination port). The duties of the CIF seller include the cost of goods, insurance, and all transportation and miscellaneous charges to the named place of debarkation. 2) C&F (Cost and Freight); the buyer bears the cost of insurance, but the seller bears the cost of goods and transportation. 3) FAS (Free Along Side) at a named U.S. port of export. The price includes the cost of the goods and charges for delivery of the goods alongside the shipping vessel. 4) EX (named port of origin). The price quoted covers costs only the point of origin. 5) FOB (Free On Board) is a widely-used quotation in export trading. In this instance, the exporter is responsible for all risks, responsibilities and expenses involved in having the consignment of goods placed over the ship's rail. At this point, the importers make all necessary arrangements to receive the consignment when it arrives at the destination port.

2.3.5 International Logistics and Supply Chain Management

Logistics refers to the physical movement of goods, also is the selection of a dependable mode of transportation that ensures the safe arrival of the goods within a

reasonable time for a reasonable carrier cost (Witt, 2005). While International Logistics has to lead with a set of agent and activities carriers, warehouses, export regulations, import regulations, customs agents, freight forwarders and so on, each of which must be accessed individually by the logistic person. Understanding the international logistics supply chain management is directly related to minimize cost, improve communications among customers or suppliers, and maintain high quality products and to have a better probability of succeeding internationally.

2.3.6 Pricing for International Markets

According to international marketing experts, pricing is one of the most complicated decision areas. In order to determine price, experts suggest taking into account the market conditions, the group of competitors, and the costs of transportation. Atish and Holger (1994), studied two alternative models of pricing behavior as follows. 1) Pricing to market, which has been studied by many economists. They said that this price depends upon the market structure in the destination country. 2) The second model that Atish and Hoger suggests is the “menu costs”, which says that the firm cannot price without having a cost escalation. Parsley (2005) studied how to price in international markets and he found that the exporters determine prices, taking into account exchange rate, and destination-market local current prices. He also found that the method mostly used is pricing at market. Experts also state that pricing at the consumers’ level requires a combination of intimate knowledge of market costs and regulations, awareness of possible countertrade deals, infinite patience for detail, and a shrewd sense of market strategy.

2.3.7 Principals on Marketing Practices

It is well known that the first point to consider when undertaking a project of export must be guided by the principles of marketing that have been extensively studied by experts. One of the most common methods is the approach to marketing for a particular product. There are many approaches supported by practices that marketers make daily and theories developed by professional experts.

2.3.7.1 Approaches to Marketing

Seperich and Beirlein (1994) identified five approaches that a firm uses to market its goods. These approaches are as follows. 1) Produce as much as possible at the lowest possible cost. The firm is not interested in the needs of consumers, but in their costs in order to produce at the lowest cost to get more profits. This approach was mostly used from 1800 to 1930. In this approach demand was higher that supply. 2) The second approach is to market high quality products. With this approach, the firm targets the premium price as a result of the recognition of the value of its products. Some firms still use this approach. 3) The third approach relies on a strong sales effort to get consumers to purchase the products. This approach assumes that, with enough sales pressure, anything can be sold. This approach was widely used from 1930 to 1970. 4) The fourth approach shifts the focus from sales to meeting consumers' needs. In other words, if a product fills the consumer needs, it has a right price, it is readily available, and it is promoted properly, marketing success will follow. This approach became popular from 1970 on. 5) Finally, there is the last approach which extends the marketing effort to include consumers' and society's well-being. This innovative approach reaches some market niches. In these modern times, there are other approaches related to the social media,

internet and others, in which the marketing principles are still kept. The next section will be limited to the marketing approach.

2.3.7.1.1 Marketing Approach

The marketing approach is based on meeting consumers' needs while making at least a normal profit. In order for the agribusiness to fill consumers' needs, there are three different groups of people involved in this commitment: 1) people who farm the land, 2) those who provide inputs (feed, seed, and fertilizer), and 3) those who process the outputs (the commodity processor, food manufacturers, food wholesalers, and food retailers). Because of this expanded view of agriculture, the food and fiber system is now called agribusiness. These activities are vitally important to move products from producers to consumers. Whether the distance is no more than a few meters, from garden to roadside stand or thousands of miles to international markets, all of these tasks must be done.

One of the challenges is to develop a system that combines all those three groups working together appropriately to ensure that the product that is being put into the hands of consumers has the features that consumers want, and can afford. It is even more difficult when the target market is a market with specific features of a population group, with different culture, different language, longer distances, unknown government policies, unknown competence, wide-spread proverty, and so on, as the international business environment often is. Added to this, the perishability of the product itself and postharvest handling to maintain quality are additional challenges.

For these reasons it is recommended to work with the marketing approach. Much research has been conducted on this subject, and it follows the familiar marketing mix.

Marketing mix tries to explain how product, price, promotion and place interact in order to meet consumer needs and wants.

Many researchers advocated for the “marketing mix,” known as the “4Ps” (Product, Price, Place, and Promotion). The marketing mix begins with product that fully meets the needs of consumers in the target market. This also could include packaging, branding, feelings, attitudes and other cultural nuances, necessary to satisfy target customers. Knowing consumers’ needs and learning how marketers handle specific products for different consumers helps to develop the “marketing sense”. The choice of marketing mix also depends on the position of the product in its product life cycle. Several marketing mixes of price, place, and promotion is required at each stage of the cycle (McCarthy, 1964; Kotler, 1996; Seperich and Beierlein, 1994).

McCarthy, 1964; Kotler, 1996; and Seperich and Beierlein, 1994; explained extensively in various publications, that along with a product that satisfies consumer needs, the seller must also try to sell the product at an attractive price, since price is the only one of the four P’s that directly affects the amount of money coming into the firm and thus its immediate financial success. They also suggest that all price decisions should be made with a clear goal in mind, for example; when a new product is introduced, researchers suggest using a pricing strategy referred to as pricing at the market. Pricing at the market is the simplest pricing policy (McCalley, 1996). This pricing strategy means that the establishment of the price represents how the competitors see the market, their cost, and their view of how customers will respond. Other experts suggest that a better approach is to price according to the product’s total costs of production plus a margin of

profit and overhead, and see how customers respond. The same suggestions are made when pricing internally as it was explained in the above sections.

The next "P" is Place, sometimes called distribution. Place deals with the movement of products from producers to consumers. Place is all the people, firms, and activities that make sure that the right product, with the right price, is in the right place so that the consumers in the target market can buy it. This group includes wholesalers, retailers, brokers, manufacturers' representatives, sales agents and others middle people who move the products through the marketing channel. It also includes the transportation, warehousing, and other firms that are involved in the physical movement and storage of products.

Next "P" is promotion. The firm tries to provide the target market information about the product in the best form possible at the right price and in the right places to convince the consumer that this is the best product to meet their need. They also wish to convince the market that this particular product will meet and exceed their needs and expectations. Promotion includes events held at target stores, information in media outlets in target countries, and point-of-sales materials to promote the sales. Promotion often includes both informational or educational materials (e.g., how to prepare the product) and perception appeals that are meant to enhance a product's attractiveness (e.g., tastes great).

Finally, Delgado, 2013 claim that many firms that follow the 4 P's still fail. If a firm sticks only to these four elements to evaluate the success or failure of their business, they may not adequately monitor the conditions and potential (future). There also may not be sufficient oversight of the process. To solve these problems, some experts

recommend “Strategic Marketing”, which takes care of “processes”, “physical environment”, and “personal. These are the other 3 P’s that complement the marketing mix. Delgado, 2013, also suggest that these 7 P’s are essential to success in the international marketing; however, when combining all activities between production and consumption in produce, the experience of this research suggests an eighth P, adequate pre-harvest and postharvest practices, which also is essential to successful marketing of perishable agricultural products.

2.3.7.1.2 Marketing Channels

Other topics extensively studied by experts are the marketing channels. There are two manners to connect products with consumers, direct and indirect marketing. 1) Direct marketing, which is a marketing system whereby the producer is involved immediately with the end user, or consumer. In other words, it is a process that uses no middleman. 2) Indirect marketing, which is mostly used when agricultural products move through traditional, long, distribution channels that include some or all the following people: producers, processors, manufacturers, wholesalers, retailers, and consumers. The problem with this method is that this long channel does not usually include any direct control between the manufacturers and the consumers. The main difference between both direct marketing and indirect marketing is that, in direct marketing, there are fewer middlemen but not less marketing functions. As with those marketing concepts related to the marketing approach, there are many other strategies to take into account when marketing produce.

2.3.7.1.3 Economic Role in the Marketing System

An important factor to understand the marketing system is the economic role. The focus of this research is not economic; however, the outcomes of any domestic or international business are influenced either positively or negatively by the role of the economics in a given context. The economic role is widely known as the form or means of meeting human needs and wants with limited resources. Although the core of this research focuses on the production and handling of apples, it is critical to understand how economic markets provide signals using prices and profits to coordinate the flow of goods and services from producers to consumers. Based on this concept, it is important to understand how demand and supply interact with each other to meet human needs and how this interaction will impact the success or failure of any business in the marketing system.

According to Katzner (1970), the model of supply and demand describes the interaction between consumers and producers in the market place for a particular product. Katzner also states that this model predicts that, in a free and competitive market, the price will be set according to the quantity demanded by consumers and the quantity supplied by producers, resulting in an equilibrium in which consumers are willing to buy what producers offer at a price that equals the producers minimum average total cost thereby giving the consumer the lowest price possible that still allows the producer to make a normal profit.

The supply and demand model states that in a free market, the number of products offered by the producers and the quantity of products demanded by consumers depends on the market price of the product (Muth, 1961). The law of supply is directly

proportional to the price, when the product price is higher, more units will be available to consumers. By contrast, the law of demand states that demand is inversely proportional to the price, the higher the price, the lower consumer demand. Therefore, the supply and demand can alter the final price. Also, Lancaster (1971) shows in his study that different people have different levels of "want", and therefore are willing to pay different prices, that is they are positioned at different points on the market demand curve. He also says that this level of "want" affects the law of demand affecting the total quantity demanded at each price. However, for a producer to exploit this difference between consumers requires price discrimination practices that are ruled out in a perfectly competitive market. To charge different consumers different prices requires that the consumers can be separated and that arbitrage will not intervene to eliminate the price difference.

2.3.8 Export Process

After analyzing many difficult factors that are part of the international business environment, and concluding that one of the most used strategies to initiate business internationally is by exporting, it is no surprise to discover that firms want to export as a first step in their marketing plan.

There are hundreds of reasons why a firm chooses to export. Some of those reasons are mentioned by Eric Sletten (1994) as a result of his experience doing business internationally and in international marketing. These reasons are stated as follow; 1) intense competition in domestic markets 2) profits, 3) survival and generate additional revenues, 4) enhance the value of the firm properties or assets, 5) diversify the income firms, 6) minimize the impact when domestic market is not profitable, 7) market intelligence (internationally, firms can be more aware of innovations, new products and

market trends and opportunities), 8) saturation in the domestic market, 9) unsaturated new markets and 10) economies of scale. To export agricultural products to foreign markets, there are many important considerations, including exportation laws, packing requirements, documentation required, etc. The following section describes the most important practices for export of apples from Massachusetts to Central America.

2.3.8.1 Phytosanitary Documentation

Before exporting products to any country, it is necessary to go through the process of Export Certification, which is a service provided to assist US applicants in meeting the import requirements of foreign countries. For example, to export apples to El Salvador, the requirements include an inspection and Phytosanitary Certificate Additional Declaration (AD), stating that, "The shipment has been inspected and found free of pink hibiscus mealy bug and originated in an area free from the insect". These applications are electronically entered into the USDA (United States Department of Agriculture) Phytosanitary Certificate and Issuance Tracking site (PCIT) (FDA 2012).

2.3.8.2 Transport Documentation and Procedures

The largest volume of international apples trade is still carried by sea. Therefore, much of that trade and its commercial, legal, and financial systems revolve around ships and shipping practices. For shipment apples from Massachusetts to Central, the first step is the selection of an appropriate vessel or shipping line, the methods of procuring space and the various aspects of freight rates and calculations must be considered. The next stage is the preparation of the bill of lading, which shows evidence of contract of affreightment, a receipt for goods shipped, providing details as to the quantity and

condition when placed on board and a document of title, without which the delivery of the apples cannot normally be obtained.

2.3.9 Standards for the Apple Industry

Since this research is related to the fresh apple commodity, this section will focus on the standards for the apple industry. According to the U.S law the following standards for the apple industry are required.

First, there are five apple grades (USDA and AMS, 2005): 1) U.S. Extra Fancy, 2) U.S Fancy, 3) U.S. No.1, 4) U.S. No. 1 Hail, and 5) U.S. Utility. According to the USDA mentioned by the University of Cornell, in addition to the requirements specified for the grades, apples of these grades shall have the percentage of color specified for the variety. It also mentions that the solid red varieties, the percentage stated refers to the area of the surface which must be covered with a good shade of solid red characteristic of the variety. In addition to the color requirements the grade standards state that for the different grades, no more than 10 percent of the apples in any lot may fail to meet the requirements of the grade, not more than 5 percent shall be seriously damaged, and not more than 1 percent shall be affected by decay or internal breakdown (USDA, 2002). Another important characteristic that has a great influence in the apple industry is apple size. Size is designated by the numerical count for a container (USDA, 2002); not more than 5 percent of the apples in any lot may be smaller than the designated minimum, and not more than 10 percent may be larger than the designated maximum. According to the U.S. law, apples tray packed or cell packed in cartons shall be arranged according to approved and recognized methods. Packs shall be at least fairly tight or fairly well filled.

U.S. Condition Standards for Export include the following: "1) Not more than 5 percent of the apples in any lot shall be further advanced in maturity than firm ripe. 2) Not more than 5 percent of the apples in any lot shall be damaged by storage scab. 3) Not more than a total of 5 percent of the apples in any lot shall be affected by scald, internal breakdown, freezing injury, or decay; or damaged by bitter pit, Jonathan spot, water core except that invisible water core shall not be scored as damage when these condition standards are applied to the Fuji variety of apples, or other condition factors: Provided, That: 1) Not more than a total of 2 percent shall be allowed for apples affected by decay and soft scald; 2) Not more than 2 percent shall be allowed for apples affected by internal breakdown; 3) Container packs shall comply with packing requirements specified of the United States (Federal Register/ Apples; Grade Standards. (n.d.))

CHAPTER III

PRODUCTION AND HANDLING PRACTICES TO EXPORT MCINTOSH APPLES TO CENTRAL AMERICAN MARKETS

3.1 First Experiment: McIntosh quality assessment treated with 1-MCP along the supply chain from Massachusetts to Central America

3.1.1. Introduction/Background

The major goal of this study was to enhance the opportunities to market McIntosh apples in Latin America. Since apple quality is one of the major concerns in exporting McIntosh to Central America, this study evaluated McIntosh fruit quality-retention in the value chain from Massachusetts to Central America. This postharvest study focused on the handling practices used in export logistics, transportation, distribution, and retail, and how these practices affect quality at the final destination. In order to conduct this analysis, a commercial container of McIntosh apples was shipped to the primary importers in Central America to evaluate costs, quality and consumer sensitivity to prices and preference. Consequently, this study has two major experiments: 1) McIntosh apple quality assessment, and 2) Price determination by exporting McIntosh apples to Central America.

3.2 Methods

In order to conduct this first experiment, one commercial container of McIntosh apples was shipped to El Salvador on November 12, 2012. This container had 15,860 lbs. of apples that were purchased from two commercial orchards in Massachusetts. These apples were harvested in September and were intended to arrive in Central America for

the Christmas holiday season, which extends from the end of November to the end of December.

Samples of apples from this shipment were taken to measure firmness and weight upon arrival at customs in El Salvador, at the distribution center, and at supermarkets. The sample consisted of 100 apples from each orchard, and measurements of firmness were taken at each apple orchard. Then upon arrival at El Salvador customs, 80 samples were taken to measure firmness and weight, as well as appearance quality. At the distribution center, the samples were assessed for external or internal storage disorders and firmness, and weight was also measured. Then at supermarkets, 60 apples were purchased to assess firmness and appearance. An Effigi penetrometer (1.1 cm head) was used to measure flesh firmness by determining the force required to penetrate the flesh (after peel removal) to a depth of approximately 1cm.

3.2.1 Apple Sources

Apples for export came from two different apple orchards in Massachusetts. The first source was an orchard known as one of the most experienced wholesalers in the New England apple industry. In addition to industry recognition, this orchard also had exported apples to European markets. The second source was a retail apple orchard which usually produce apples for local markets and direct sales and had no experience with wholesale packing, shipping, or export. Apples from both orchards were harvested according to the experience of each apple grower. The only requirement requested at purchase was that apples were treated with 1-MCP (SmartFresh™), a chemical that interferes with the action of ethylene, a natural hormone which enhances ripening and

senescence. This treatment maintains firmness of apples for shipment over long distances or for long-term storage. Both orchard growers followed the label protocol.

Sixty-one bushels of 120-count and 135 bushels of 88-count Extra Fancy McIntosh apples were purchased from the commercial wholesale orchard. These apples were harvested on September 26, treated with 1-MCP, and placed in controlled atmosphere (CA, 2.5% CO_2 and O_2) at 3°C. One hundred and ninety-four tray-pack cartons of 80, 100, and 125 count U.S No.1 McIntosh apples were purchased from the retail orchard. These apples were harvested on September 28, treated with 1-MCP, and placed in refrigerated storage at 0 °C. Apples from both orchards were shipped to Central America by the sea freight company DOLE on November 19. The shipment arrived in San Salvador on December 6.

3.3 Results

3.3.1 Firmness of McIntosh Apples Treated with 1-MCP from Two Orchards

To determine if there were significant changes in the quality of McIntosh apples treated appropriately with the best pre-harvest and postharvest technology, data were taken by exporting McIntosh apples from Massachusetts to El Salvador, Central America. The apples that were exported came from two different apple orchards in the state of Massachusetts. The first source was an apple orchard known as one of the most prestigious wholesalers in the New England apple industry (first apple source). In addition to this industry recognition, this orchard also had experience exporting apples to European markets. The second source was an apple orchard which usually grows apples for local markets and direct sales (second apple source). Apples from both orchards were

harvested according to the experience of each apple grower. McIntosh apples were treated with 1-MCP by each apple orchard.

Apple samples were taken to measure firmness throughout the supply chain, including prior to shipping to Central America, upon arrival at customs in El Salvador, at the distribution center, and at retailers. Regarding firmness results, this research has shown that there were significant differences between apple sources (summarized in Table 2). Prior to shipping, Flesh firmness apples from the first source (wholesaler orchard) was 14.3 lbs, and from the second source (non-exporter orchard) was 11.7 lbs.

The apples for this study were loaded into a container on November 12, 2012 and transported to Wilmington, DE. They were kept in a warehouse for 7 days, and on November 19, the apples left the ocean port in Wilmington, DE and traveled to Central America via container ship. Fruit arrived in Puerto Castilla, Honduras on November 27, via direct service. Due to a delay in payment to shipping company, the apple container was kept in Puerto Castilla until December 3. Upon release, the container was transported by land to San Salvador, arriving at El Salvador Customs on December 5, 2012.

At El Salvadoran Customs, the container was opened in order to inspect the apples. The inspectors' decision to open the container was based on the knowledge that apples from the northeastern United States had not been previously imported. Other apple containers entering El Salvador at that time did not require inspection. During the inspection the McIntosh apples were out of the container for 4 hours at 34 ^{O}C. After these 4 hours, samples were taken, and flesh firmness was measured. Both apple sources had small changes in firmness compared to the firmness at the loading port, as displayed in

Table 3.1; however; a significant difference in firmness between apple sources was observed.

At El Salvador Customs, the container was kept for 6 days due to delays in getting paperwork from the inspection government offices. Inspection paperwork was obtained on December 11, and apples were delivered to the distribution center in San Salvador later that evening. This distribution center is an enormous facility that provides storage facilities to different fruit and vegetable importers.

The following day, after delivering the apples to the distribution center, one 80-apple sample were taken to measure firmness. Changes in firmness were noticed for both apple sources. Average flesh firmness of apples from the retail orchard decreased from 10.4 to 7.6 lbs, while firmness of apples from the wholesale orchard decreased from 13.7 to 12.3 lbs. The latter firmness would be considered by apple buyers in El Salvador as high quality (Figure 3.1). In El Salvador, supermarket chains accept apples above 12 lbs as high quality apples.

Finally, apple samples from the wholesale apple orchard were taken at the retailers. Samples from the retail orchard were not taken as they were not at the same retailer. There were small changes on firmness; however, the apples were still firm enough to be considered high quality (Figure 3.1). Following delivery, apples were bought from the supermarket, and data were collected after 6 days, measuring an average firmness of 9.1 lbs (Figure 3.1).

Overall, McIntosh apples from the wholesale orchard, treated with SmartFresh, and shipped to Central America maintained high flesh firmness. However, fruit from the

retail orchard, treated with SmartFresh, were not firm enough through the supply chain to be considered of high quality (Figure 3.1).

3.3.2 Effects of Size on Flesh

Flesh firmness varied differently with the orchard source. Eighty-apple samples from the retail orchard were taken from the 80-count and 125-count size categories. Firmness of the smaller 125-count apples was significantly greater than firmness from the 80-count fruit (Figure 3.2). At El Salvador Customs, the 125-count apples measured 11.4 lbs, while the 80-count apples were 9.4 lbs. At the distribution center, firmness was only 6.0 lbs for 80-count, while for 125-count fruit it was only 9.1 lbs (Figure 3.2).

3.3.3 Weight per Box of McIntosh Apples Arriving at the Distribution Center

The standard apple box in commerce is considered to be 40 lbs of fruit. In this study, there were significant differences in weight per box by box count and apple source. The 125-count boxes from the retail orchard weighed 35.6 lbs on average, and the 120-counts boxes from the wholesale orchard weighed 39.1 lbs per box. In El Salvador, the boxes from the wholesale orchard were close enough to the 40-lb standard, but those from the retail orchard were considered short of fruit. The 80-count boxes from the retail orchard weighed only 27.6 lbs on average, far below what the market requires (Figure 3.3, Table 3.2).

3.3.4 Effects of Supply Chain Delays on Flesh Firmness

Since McIntosh apples have never been sold in Central America, and have never been exported from Massachusetts to Central America, there was no information about shipment locations or duration. These results show that the time required to export apples from Wilmington, DE to Honduras was 8 days. As it can be seen from Figure 3.4, the

apples were loaded on November 12 at the UMass Cold Spring Orchard and left from the loading port in Wilmington, DE on November 19. They arrived at the discharge port in Honduras on November 27. If they had not been delayed at the discharge port due to payment, then they would have arrived to El Salvador Customs on November 29; however, they did not arrive until December 5 because of the delayed payment. Another important factor which affected the time of arrival at the final destination was a 6-day delay at El Salvador Customs. The apples arrived at the distribution center on December 12. In total, 30 days elapsed from the orchard to the distribution center in El Salvador. Without the avoidable delays, no more than 10 days would have been needed to ship apples from Wilmington, DE to El Salvador (Figure 3.4).

3.3.5 Temperature

Throughout the supply chain, temperature was observed on each location. There were significant variations once the apples arrived in El Salvador. Up until day 23, the temperature was maintained at 0 ^{O}C. When the apples were in the El Salvador Customs inspection process, they were kept at 34 ^{O}C for 4 hours. After inspection, the apples were kept in the container for an additional 5 days until the inspection paperwork was released. During those 5 days, apples were in the container at 0 ^{O}C.

Apples were delivered to the distribution center by day 28.3, and they were stored at 15 ^{O}C for 16 hours before being delivered to the retailers. When apples were at the retailers, the temperature was kept at 8 ^{O}C. When apples were on the supermarket shelf, 80 apples were purchased to measure firmness at the last stage of the supply chain. After 2 days, no apples remained at the retailers, as all had been sold at $1.35 per pound. As

shown in Figure 5, firmness of apples from both sources decreased considerably the inspection at 34 ^{O}C.

In conclusion, these results show that quality retention is not dependent on 1-MCP alone. Other factors throughout the supply chain, such as apple sources, storage method, temperature control, and delays by government offices and administrative processes affect the quality of McIntosh apples at the final market. Also in formulating shipment strategies to export McIntosh apple specifically to Central America, it is highly recommended to take the above mentioned factors into account.

3.4 Discussion

The goal of this study was to determine whether or not there were significant changes during the export process in the quality of McIntosh apples treated with Smart Fresh. These apples were treated appropriately with the best pre-harvest and postharvest technology throughout the supply chain from Massachusetts to Central American Markets.

Food supply chain is defined as a consumer oriented approach and focuses on product flows between production and consumption (Fet, 2000). There are many steps between production and consumption, but each particular commodity has its own protocol to flow from growers to consumers. For this study, it was found that the supply chain between Massachusetts apple growers and Central American consumers involved production, packing, ocean freight, customs clearance, warehousing, local transportation, and distribution to retailers. Actors involved in the process during this study included growers, packers, wholesalers, inspectors, shippers, exporters, importers, distributors, retailers, and consumers. Each actor of this supply chain had a very important role in

retaining the quality of McIntosh apples. This section will discuss their roles and their practices.

3.4.1 Best Handling Practices (BHP) Throughout the Supply Chain

Best handling practices are known as the selection of the best technologies to be applied among a range of available pre-harvest and post-harvest technologies. To select different technologies, some factors should be taken into account. The most significant factors mentioned by many researches are the product characteristics, the market distance and requirements, and the social and economic conditions of the actors involved.

This study intends to approach BHP for products by understanding the proper product handling during the postharvest chain. How participants in the supply chain understand BHP affects the quality and safety of the product. In addition, this understanding helps to identify problems relative losses in product or quality and to identify possible solutions.

3.4.1.1 Growers, Packers, and Wholesalers

As this research is a practical pilot project, many details were observed during the process through the supply chain. First, as (Fet, 2000) mentions in his research, the perception of quality is dependent on the supply chain actor. He believes that growers, in general, perceive quality as productivity, uniformity, and the lack of pest damage. In this study, it was observed that perceived quality is dependent on experience and knowledge of each apple grower. It depended on the final destination of their apples. As can be seen in this study, even when both apples growers treated their apples with SmartFresh, which is the highest technology to retain quality, results were different depending on the apple source.

Bulens, I. 2012; DeEll, Jennifer R. 2008; Lu, Xingang 2013; Mir, N. A. 2001; have shown that the effectiveness of any postharvest technology depends on several factors. For example, for 1-MCP (SmartFresh), the protocol of applying this gas to apples is one of the most important factors affecting its effectiveness. In addition to the application protocol, another significant factor to consider is the stage of development of the fruit. Although SmartFresh can have a great impact on the maintenance of apple quality and other factors such as cultivar can affect quality retention, the most important technique for controlling the loss of quality along the supply chain is temperature reduction.

Retailers and wholesalers in Central America require apples to have at least 12 lbs of flesh firmness to be accepted as high quality. In this study, apples from the two sources had different firmness. Fruit from the retail orchard were less than12 lbs on average, whereas those from the wholesale orchard were more than 14 lbs. As might be expected, apples from the wholesale orchard were firmer throughout the supply chain.

Another important finding of this research was effects of size on firmness of apples. Mann, et al., 2005; Von, 1992; Marmo, 1983 found that apples with a smaller size are firmer and have better quality retention. It was demonstrated on this study, smaller apples from both orchards had higher firmness in the Central American market than larger apples.

For this study, once apples were ready to be inspected, officers from the Massachusetts Department of Agriculture came to the packinghouse to inspect apples for the export certificates to Central America. At this point key factors, such as appearance quality, were assessed by the inspector. However, firmness and weight were not assessed

for the export certificates. Taking into account their importance on the final markets, these factors should be part of the criteria to export apples and also sell them domestically.

3.4.1.2 Shippers, Exporters and Importers

This study included all activities between production and consumption so as to understand and overcome barriers between apple growers in Massachusetts and Central American consumers. A commercial shipping company was hired. During this process of selecting a shipping company, it was learned that shippers required large-volumes of fruits. It was also learned that these shipping companies, have significant market power related to fresh produce handling practices, since there are only a few in the market and have control over their clients.

Temperature through the ocean freight was kept at 32°F, which is the recommended temperature for McIntosh apples. During this shipment, there were some administrative delays caused by a delay in payment from the exporter. At the destination port, the apples were kept in custody until the payment was made. Overall, there was not any mismanagement observed during the transportation of the apple container from the port of loading to the port of discharge. As a result, this study found that this shipping company knew what handling practices are needed for apples.

3.4.1.3 Customs Clearance Inspectors

Once the apples arrived at customs, they were inspected, including the measurement of firmness. At this step in the process, fruit softened, because they were kept at 34°C for 4 hours during the inspection process. It was clear that customs inspectors were not aware of how to handle apples. In addition to the lack of knowledge

in handling apples they were not interested in releasing the container quickly. It was also noticed during this process, no other apple container was required to be inspected. Other importers simply paid their import taxes and did not discharge their apples at this location. The apples on this study were finally released 6 days after arriving at customs.

3.4.1.4 Distribution Center (DC)

The supermarket, to which the McIntosh apples were shipped, is the biggest local supermarket chain in El Salvador. It has 79 stores in El Salvador. This supermarket has an agreement with a distribution center (DC) which distributes produce throughout El Salvador. This DC broke the shipment in to smaller units and distributed them to different stores.

This DC is the largest in El Salvador and Central America, and many importers and exporters use this center to handle their fresh produce. The apples were delivered to the DC on the same day that they were released from customs and were distributed the following day. However, the employees in charge of handling the apples in this center left them overnight (16 hours) at 15°C.

The following morning, when workers were weighing apples, some boxes weighed less than expected. The boxes of larger apples weighed less than the boxes of smaller apples. That day, samples were taken to measure firmness and weight. Some apples showed bruises on their skin. These blemishes were noticed on the largest apples and the apples which were at the bottom of the container. Softer apples bruise more readily, and the inappropriate warm temperatures during customs inspection and at the DC likely resulted in softening. In addition to the effects of temperature, the apples were

manipulated many times, and people in the DC were not aware of how to handle the apples appropriately.

3.4.1.5 Retailers

Once the apples were delivered to the supermarket, the largest apples from the retail orchard were not firm enough to be considered of adequate quality. All fruit from the wholesale orchard and the smallest fruit from the retail orchard were firm enough. These higher quality fruit were sold in two days. At the supermarkets, apples were kept at 8 °C, and workers were trained in best handling practices for apples before McIntosh arrived.

3.4.2 Temperature

It is well known that temperature is the single most important factor in the postharvest life for any perishable produce. Temperature reduction has a far greater impact on retention of quality than any other postharvest manipulation.

The postharvest temperature is such an important factor because it regulates the rates of biological reactions. It is known that increasing temperature results in an exponential rise in the rate of respiration. This exponential rise is only applied within the physiological range and it follows the Van't Hoff rule, which says, "The chemical reaction doubles for each 10 °C rise in temperature. The coefficient for 10 ^{O}C interval is called the Q_{10} temperature coefficient." (Kays & Paull, 2004).

Table 5 shows that Q_{10} of biological reactions is between 2 and 3. For example, biological reactions are 2.5-3 times faster at 10^{O}C compared to 0^{O}C. This Q_{10} relates directly to the loss of quality of produce after harvest.

3.4.3 SmartFresh™

Mir, N.A. 2001; Moran, R.E. 2006; Watkins, C.B. 2000; McArtney, S.J. 2008 have studied the effectiveness of 1-MCP (SmartFresh™) at maintain quality of apples after harvest. Some of the most important benefits of 1-MCP mentioned by those experts are maintenance of firmness, reduction of respiration, delay of ripening and senescence, and prevention of superficial scald and soft scald. Effectiveness of 1-MCP can be altered by the timing of application, complementary postharvest technology, and maintenance of the cold chain strictly. Argenta, L.C. 2005; 55 DeLong, J.M. 2004 suggest that to realize the maximum benefit from 1-MCP on apples, SmartFresh™ must be used immediately after harvest and at the optimum level of maturation for long-term storage. Researchers have also found that for optimum quality of apples is maintained if the fruit are stored at modified atmospheres (3% oxygen and 5% carbon dioxide for McIntosh).

3.5 Conclusions

Throughout the supply chain for McIntosh apples from Massachusetts to Central America, it was determined that each one of the actors forming this supply chain has an important role in maintaining apple quality. Factors of particular importance that affect quality include the apple source, fruit size, and proper temperature maintenance.

These results and conclusions are only part of the picture. To make the decision to export McIntosh apples to Central America, there needs to be an economic analysis indicating that it is profitable for growers in Massachusetts. The following analysis will discuss the financial results and the steps to export to Central America.

3.6 Tables and Figures

3.6.1 Tables

Table 3.1: **McIntosh apple flesh firmness (lbs) in the supply chain, from Massachusetts to Central America, 2012**

Supply Chain	Wholesale orchard (1)	Local retail orchard (2)	Cumulative number of days from departure	Temperature (◦ C)
Loading Port	14.3	11.7	0	0
El Salvador Customs	13.2	10.4	23	34
Distributor Center	12.1	7.6	30	15
Retailers	11.3		31	15
Final Consumer	9.1		37	0

(1) Sixty-one bushels of 120 Extra Fancy McIntosh and 135 bushels of 88 Extra Fancy McIntosh apples were purchased from a commercial wholesale orchard in Massachusetts.

(2) One hundred and ninety-six tray pack cartoons of 80-, 100-, and 125-count U.S No.1 McIntosh apples were purchased from a commercial retail orchard in Massachusetts.

Table 3.2: Effects of fruit size on flesh firmness of McIntosh apples (from a retail orchard) through the supply chain from Massachusetts to Central America, 2012

Supply Chain	Cumulative number of days from departure	Firmness (lbs)		Temp (◦ C)
		80-count	125-counts	
Loading Port	0	11.7	11.7	0
El Salvador Customs	23	9.4	11.4	34
Distributor Center	30	6.0	9.1	15

Firmness of McIntosh Apples treated with 1-MCP (SmartFresh™). Samples of apples were taken to measure firmness prior to shipping to Central America, upon arriving to customs in El Salvador and the Distributor Center

Table 3.3: Weight per box and flesh firmness of McIntosh apples upon arrival at the distribution center in San Salvador, 2012

Supply Chain	Weight (lbs/box)	Firmness (lbs)
120 Wholesaler Apple Orchard	39.1	12.1
125 Local Retailer Apple Orchard	35.6	11.4
80 Local Retailer Apple Orchard	27.6	6.0

Table 3.4: Q10 Temperature Coefficient

Temperature (^{O}C/^{O}F)	Q_{10}
0-10 (32-50)	2.5 – 3
10-20 (50-68)	2-2.5
20-30 (68-86)	2
30-40 (86-104)	<2

Source: (Kader, Morris, & Cantwell, 2001)

3.6.2 Figures

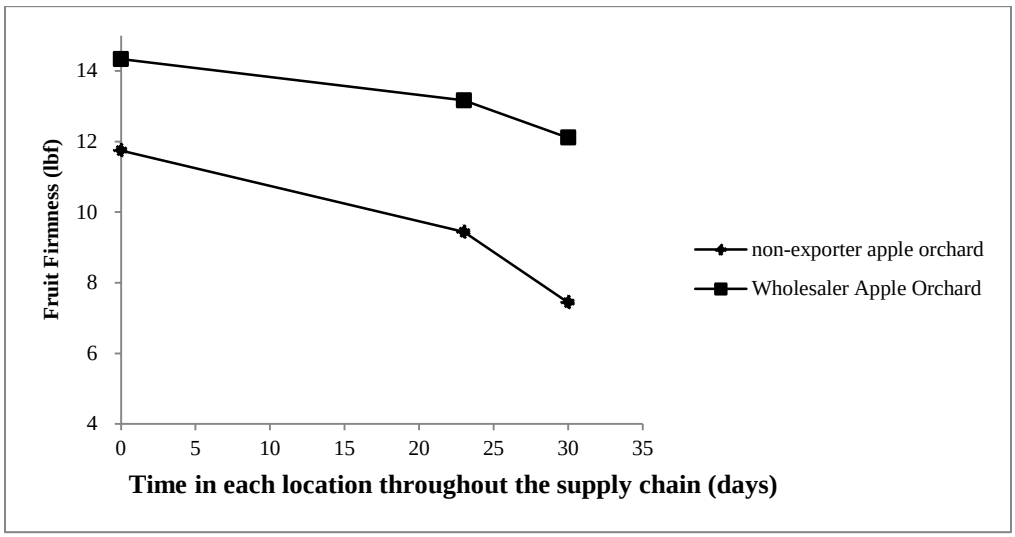


Figure 3.1: Firmness of McIntosh apples treated with 1-methylcyclopropene from two different orchards in Massachusetts. Samples of apples were taken to measure firmness prior to shipping to Central America, upon arrival at El Salvador Custom, Distribution Center, and Retail markets, 2012.

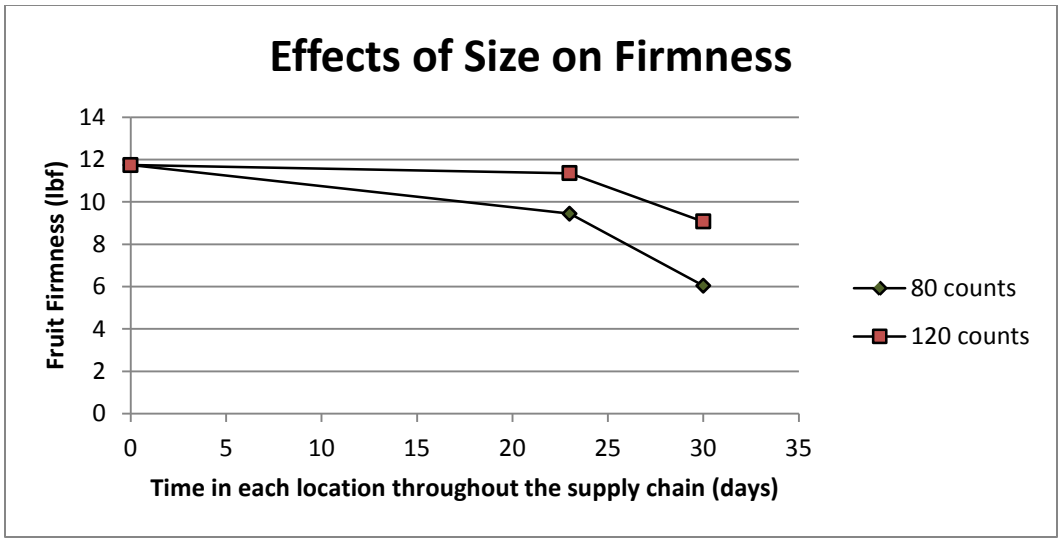


Figure 3.2: Firmness of McIntosh Apples treated with 1-MCP (SmartFresh™) from one apple source prior to shipping to Central America, upon arrival at El Salvador Custom, Distribution Center, and Retail markets, 2012.

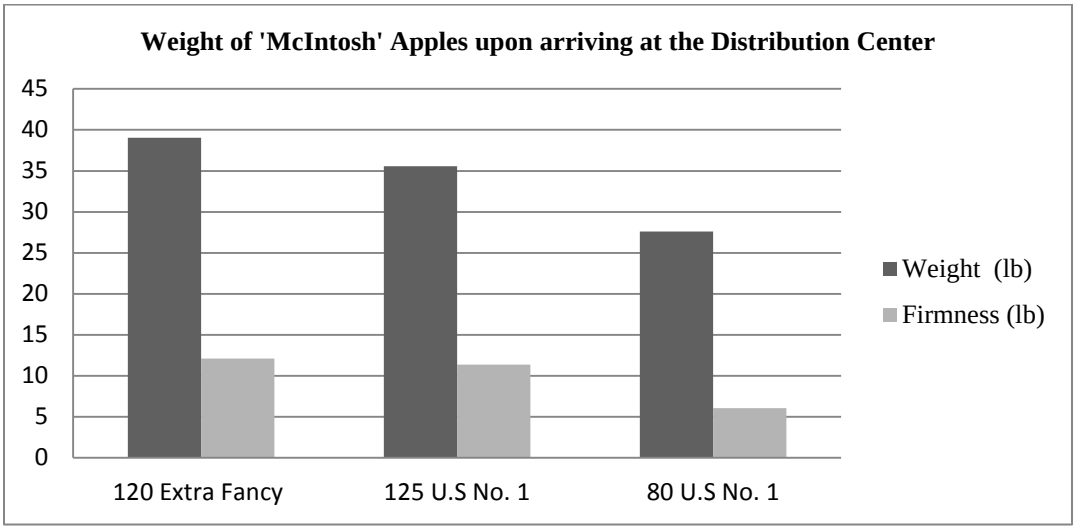


Figure 3.3: Weight per box of 80- and 125-count U.S. No. 1 McIntosh apples from a commercial retail orchard and 120-count U.S. Extra Fancy McIntosh apples from a commercial wholesale orchard in Massachusetts, 2012

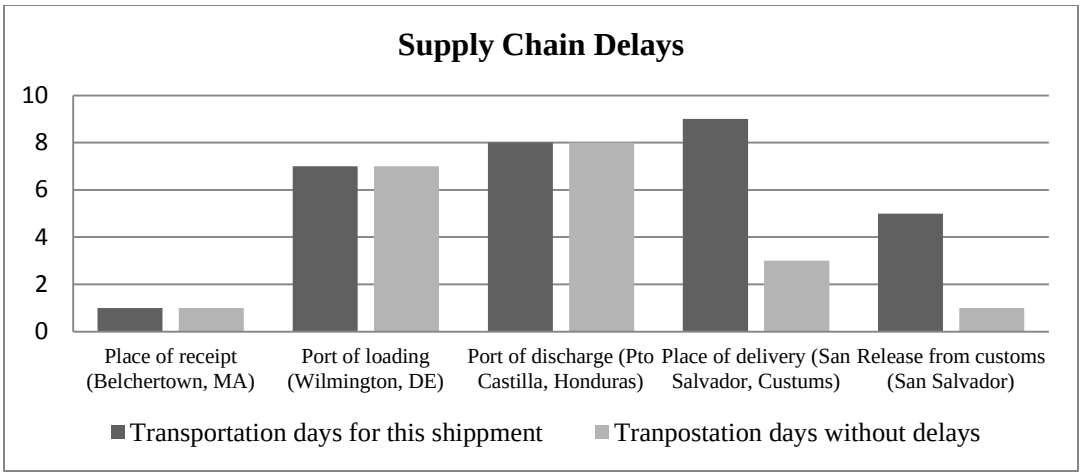


Figure 3.4: Time involved with transport from Belchertown, MA to San Salvador Customs, 2012

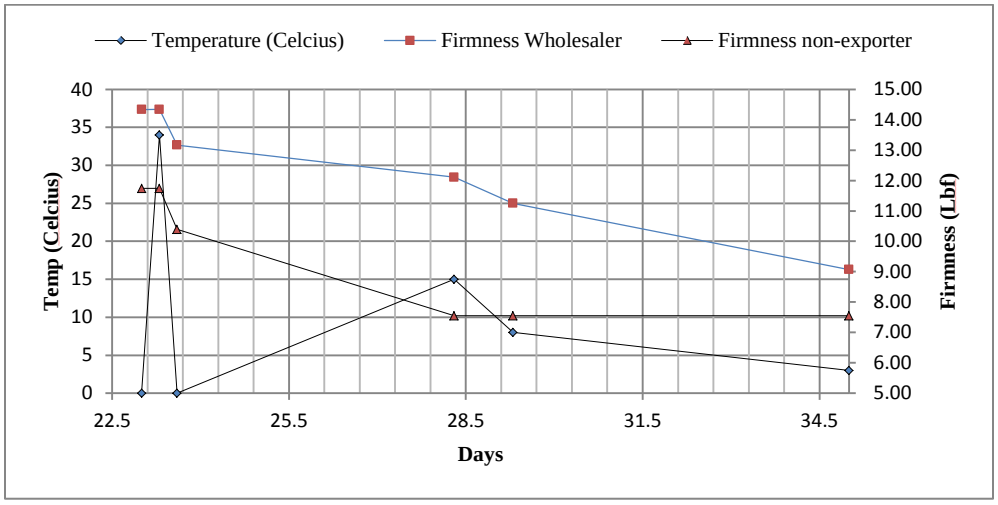


Figure 3.5: Effects of the temperature on firmness throughout transportation of McIntosh apples treated with 1-methylcyclopropene from two different orchards in Massachusetts. Samples of apples were taken to measure firmness prior to shipping to Central America, upon arrival at El Salvador Custom, Distributor Center, and Retailer market, 2012

CHAPTER IV

MARKETING PRACTICES TO EXPORT MCINTOSH APPLES TO CENTRAL AMERICAN MARKETS

4.1 Second Experiment: Price determination by exporting McIntosh apples to Central America.

4.1.1 Introduction/Background

This experiment was conducted by researching a real pilot project that furthers the export of McIntosh apples from Massachusetts to Central America. This study started in the summer of 2011 and finalized in December 2013. In the summer of 2011, three countries of Central America (Honduras, El Salvador, and Guatemala) were visited with the purpose of investigating prices of apples in the retail and wholesale markets in that region. Many different buyers were visited so as to promote McIntosh apples in those countries and to learn about their storage facilities and marketing practices in those countries. Other physical and facilities functions were also assessed, such as risk taking, market information, financing, grades, and standards for those regional apple markets. From this visit, it was concluded that any country could be a good option for conducting research, as all buyers showed interest in doing business with apple wholesalers in Massachusetts and New England. However, the minimum requirement for exporting to the largest supermarket chain in Central America was a shipment of at least one container of 980 40-pound boxes of McIntosh apples. Due to the lack of supply of apples for both 2011 and 2012, this requirement was not met. One supermarket chain in El Salvador showed interest in buying less than one container, as long as the apples arrived in El

Salvador at a CIF[1] price. To meet this request, 396 bushels of apples were shipped in 40-foot wide reefer container. Although the shipment constituted less than 50% of container capacity, at approximately 16,000 pounds it was sufficient to assess our main hypothesis regarding quality and price. Besides shipment size, all export and import procedures were in place to export McIntosh apples to the marketplace in El Salvador.

4.2 Methods

To assess one of the two main hypotheses regarding price, which says "if McIntosh is accepted by Central American consumers, Massachusetts apples growers could export to Central America profitably," all export and import procedures were put in place to export approximately 16,000 pounds of McIntosh apples to the marketplace in El Salvador. After the buying and selling agreements were completed, the export process consisted of five parts: 1) promoting McIntosh apples in Central America, 2) packing and grading the McIntosh apples, 2) documentation and inspection, 3) shipping the apples to Central America and, 4) marketing apples in Central America.

The main strategies to promote McIntosh apples in Central America were 1) personal communication with buyers and consumers, 2) brochures to educate potential consumers about the different uses of McIntosh apples, 3) a manual with the best practices to handling McIntosh apples through the supply chain, 4) a website in Spanish to promote McIntosh apples with consumers who speak Spanish, 5) and offering apples to taste in outlets and supermarkets in El Salvador.

4.2.1 Packing

[1] CIF: Cost Insurance Freight

Prior to packing, 100 samples were taken and measured for firmness by apple source. Next, the apples were graded and packed by hand at each of the orchards where apples were harvested. The criteria used to grade the apples were the standards for the apple industry established by the United States Department of Agriculture, as explained in the literature review chapter. These standards were determined primarily by size, color, uniformity, freedom from damage by insects, mechanical damage, and disorders. Once the apples were graded, they were packed into boxes. Each 40-pound box was then placed in storage to be shipped to Central America.

4.2.2 Documentation and Inspection

A number of different documents were required in cross-border marketing. These documents were in different formats and included invoices, consignment notes, and customs documents. The primary documents were obtained through freight forwarding company when the exporter acquired the apples and arranged transportation and documentation. Additional documents were obtained during this time, including the commercial invoice, bills of lading, certificate of origin, phytosanitary certificates, and export certificates. In addition to these documents, importation permits were obtained to allow the importer to clear apples through customs and deliver the shipment to the distribution center. These certificates were issued by the office of the U.S. Department of Agriculture (through the Massachusetts Department of Agricultural Resources) and from the Ministry of Agriculture in El Salvador and other international agencies. The exporter was a company legally registered in the United States, which has the appropriate roles for export. This company also supported the arrangement through the freight forwarding

company. The shipping company was selected using criteria of pricing and storage facilities.

4.2.3 Price Determination Process

The INCOTERM[2] contracted for this experiment was CIF price (Cost, insurance, freight). This contract specified that the exporter was responsible for all costs and risks to a specified destination port indicated by the buyer. To determine price, this study focused upon both internal and external factors that affect international pricing decisions. The factors analyzed included the cost structures, the value of the product, the market factors (consumers' preferences, market structure), competitor pricing levels, and a variety of environmental constraints. This research allocated all costs that were specific to export sale for McIntosh from Massachusetts to Central America. These costs included tariffs, tax liabilities, extra transport, warehousing costs, and destination costs. By reviewing the factors affecting the pricing process, this research identified the most reliable price to export apples from Massachusetts to Central America. Finally, the main sources of reference for this analysis were commercial invoices obtained throughout the supply chain, the final price that consumers bought the McIntosh apples in El Salvador, and the exportation. As previously mentioned, the purpose of this analysis was to discover the price that buyers in Central America are willing to pay to wholesalers in New England. In the same way, with the current cost structure to export apples to Central America, this study analyzed which barriers to entry to those markets could affect the apple exportation

[2] INCOTERM refers to a type of agreement for the purchase and shipping of goods internationally.

from Massachusetts to Central America and the price for McIntosh apples on those markets.

4.3 Results

4.3.1 Results on Grading and Packing

The final grades obtained from the two different apples sources for this research were 61 bushels of 120-count and 135 bushels of 88-count Extra Fancy McIntosh apples from the commercial wholesale orchard and 194 tray-pack cartons of 80, 100, and 125 count U.S No.1 from the retail orchard. After grading and packing, the certificates to export apples from Massachusetts to Central America were obtained. These certificates were: Origin certificate, Phyto-sanitary certificate and Export certificate (Appendix 1). These certificates stated that the apples met the USDA's standards for the apple industry.

4.3.2 Results on Documentation and Inspection Results

4.3.2.1 Terms of Sale

Since this research was interacting with the real players of the apple industry, and they did not have enough information about pricing, a series of discussions occurred with apple growers, exporters, marketers, buyers and other middleman regarding terms of sale on a CIF basis. The goal of this quotation ensured that both the buyer and his authorities would be able to identify the main component parts of the price structure. However, the major risk was on the exporter side. This documentation can be seen in Appendix 2. For this particular invoice the sum of $11,263.00 represent the amount for which the exporter is selling the apples, plus export costs to convert it into a CIF price.

4.3.2.2 Transport Documentation and Procedures

It was found that the logistics sector to transport fresh apples to Central America has high levels of technology to maintain high quality apples along the supply chain to the distribution center in that region. It was also found that the shipping logistics firm followed technical specifications according to the preferred postharvest handling practices, more in specific temperature control, which is one of the most important criteria when hiring a shipping company. It was also found that the minimum volume to export apples to Central America is 980 40-pound boxes. Firms can ship less that 980 boxes, but must pay the full container price. This is due to the logistic firms have 40 cubic feet reefer container and more than that, but not less. The need for refrigeration makes the cost higher than a dry cargo.

During export, the main documents were the bill of lading, (evidence of the contract of affreightment), a receipt for goods shipped (details as to the quantity and condition when placed on board), and a document of title (without which delivery of the goods cannot normally occur). The Bill of lading can be seen in Appendix 3.

4.3.2.3 Customs Procedures in El Salvador

In El Salvador, the government required phytosanitary permission and inspection fee to import the apples. Firms whose business is to import apples are required to have their own import permit and other legal requirements in order to trade internationally. Both phytosanitary permission and inspection fees were priced at $ 56.50, as it can be seen in Appendix 4. Once firms have these government requirements from

the Ministry of Agriculture in El Salvador, they hire a broker to receive the apples in El Salvador.

4.3.3 Shipping Apples from the Western Massachusetts to El Salvador

4.3.3.1 Specific 2012 Export Costs Analysis

The objective of this shipment was to study the current costs of exporting apples from Massachusetts to Central America. The main sources of this information were commercial invoices that were provided by the different companies of the apple supply chain industry or middlemen who were participating in the vertical channel. All the specific costs are summarized in Table 4.2 and are explained in the next paragraphs.

4.3.3.2 Apples Cost- FOB Price

In 2012, the wholesale FOB price for a 40-pound box of 120 counts per box was $37.00 ($0.93 per pound), which was 43% more than 2011 and 55% more than 2010. After reviewing historical records of wholesale prices at the terminal market of Boston MA (Table 4.1) and having real prices deflected by the Consumer Price Index, it could be concluded that the 2012 wholesale price was a result of an atypical year for apples growers.

4.3.3.3 Transportation Costs

Transportation costs, including sea freight, insurance, and destination costs, was $6.40 per box ($0.16 per pound), resulting a CIF price plus tariff of $43.60 per box ($1.09 per pound).

4.3.3.4 Delays Costs

The container left the port of Wilmington, DE on November 19 and arrived at the Puerto Castilla in Honduras on November 27; however, due to the late payment to the

shipping company, it was delayed by 5 days in Puerto Castilla. On December 5, the shipment arrived in El Salvador, and workers from the government office delayed the container for 5 more days. These delays cost $0.06 cents per pound for use of the container. Therefore, the final CIF price was $46 per box ($1.15 per pound).

4.3.3.5 Distributor and Retail Price

The distributor price paid for this shipment was $0.79 per pound, $0.36 less than the CIF price. The price paid by retailers was $0.95 per pound and the final price to consumers was $1.35 per pound. After 2 days, all of the McIntosh apples were sold.

4.3.4 Results on Pricing at the Market

New England apples have not been sold previously in Central America, therefore, this research used a pricing approach referred to as pricing at the market, which requires setting the price equal to other apple sellers, but currently no seller offers the McIntosh apple. For New England apples, this is a good starting point to understand the apple market structure in those countries, since the Central American market is dominated by two large competitors (WA State and Chile). The importance of this pricing strategy is that the price represents how the competitors see the market, their cost, and their view of how customers will respond, not New England apple growers. A better approach is to look at these same items in light of New England apple Growers' costs and so on, and see how customers respond.

For purposes of providing the best recommendation to the producers of New England, a practical cost exercise was conducted during the logistic process of this research. Table 4.3 provides real costs of this shipment estimated for a container (980 cartons) of McIntosh apples shipped from Massachusetts to El Salvador. The average

FOB price in Massachusetts was of $0.93 per pound, $37.20 per carton. This nominal price was $11.20 more than in 2011.

The logistics costs to transport a container (980 cartons) of apples from the eastern US to El Salvador included phytosanitary permits, pallets, temperature record, container, inland freight, ocean freight, and inspection, and were lower than a container shipped from Washington State to El Salvador. The total transportation cost via container ship was $5,980. In El Salvador, local costs included fees for inspection, import license, customs services, and labor costs, for a total about $402.55. The total cost of the container in El Salvador for the importer was about $42,642.55 plus $2,307.35 in delay cost, having a final cost of approximately $45.86 per carton. The apples comprised 85% of the cost, and logistics and transportation were the remaining 15%.

Finally, the price discovered using a pricing strategy of pricing at the market was at a FOB price of $25.10 per 40-pound bushel. It is similar to what Alvarado (2011), stated on her Marketing Analysis for McIntosh apples in Central America that was a FOB price ranging from $24 to $26 at the outset. This value is also similar to the higher priced apples in El Salvador.

Currently, several varieties of apples are sold in El Salvador, but not the McIntosh. In El Salvador the price of apples depends on the size, quality, and the variety. In addition, apples are sold under four grades: Premium, Extra fancy, and Fancy and U.S No. 1. Grade is determined by degree of color, with Premium having 100% color, Extra Fancy having 75% color, and Fancy having less than 75% color. Apple size is measured by their individual weight, which determines the number of apples per carton. For example, the size of 113 counts means 113 apples per carton, and usually the total weight

the carton is 19 kg or no less than 40 pounds. Alvarado, 2011, found that Washington State is also the state that exports the most apples to Central America, and to El Salvador. For this reason, apples imported to El Salvador from Washington State are the best point of reference for substitutes to apples from MA market prices in El Salvador.

The price of substitutes MA apples can be compared for other varieties currently sold in El Salvador. Prices vary according size, variety and quality of apples, as well as demographic considerations (Alvarado, 2011).

When apples are sold at retail in El Salvador, they acquire new and more commercialized names that are known for both their size and variety. For example, Red Apple School, family package, Big Red Apple, Small Red Apple, and other varieties. These names are important to note, because Salvadorian distributors and sellers and wholesalers go out of their way to sell branded apples that consumers desire based on the quality, size and price associated with each brand name. According to the El Salvadorian markets examined by Alvarado, (2010) sizes vary from 72 to 216 counts. However; most apples fall between 113 and 175 count (Table 4.4). For 2010, on average, the retail price per carton was approximately $43 per carton, which is $ 1.075 per pound on average. For 2012, through this researched, was found that McIntosh apples were sold at $1.35 per pound. For 2013, substitute prices ranged from $ 1.38 to $ 1.83 per pound for Gala, Fuji, Delicious and Granny Smith, sizes of 113, 150, and more as can be seen in table 9.

Consequently likely prices for McIntosh in El Salvador will be between $ 1.31 and $1.83. Since, consumers paid $ 1.35 per pound for McIntosh, 120 counts. In 2012, it appears McIntosh was not the lowest price but it was not the most expense per pound, giving an opportunity to go up.

4.3.5 Flow for an Apple from Western Massachusetts that is sold at a Supermarket in El Salvador

The complete product flow for an apple from Massachusetts that was sold at a supermarket in El Salvador included growers, packers, wholesalers, exporters, brokers in the USA and El Salvador, public agencies in U.S.A and in El Salvador, and a logistic company. Using as a starting point the found price through this research, Table 8 shows an estimate of the portion of the price attributed to each step in the product flow.

4.3.5.1 Costs of one Bushel of McIntosh in Massachusetts

The cost of production ranges from $ 7.5 to $10.00 per bushel- 40 pounds, on midrange of $8.75 per bushel (Table 4.3). The packing costs include packing charges, carton, Smartfresh, storage charges and commission charges ranges, which range from $8.1 to $11.00, $9.56 on midrange per bushel. In total, a bushel of apples to export has a cost of $ 18.75 on midrange, in Massachusetts. On the other hand, for example, for 2009, the USDA reported that 881,000 bushels were sold at a midrange price per bushel of $22.50 in Massachusetts. Consequently, it can be concluded that Massachusetts growers have around 16% of profits on average. Having a total cost of $18.75 per bushel, the price of $25.10 that importers from Central America paid for McIntosh apples in 2012 were higher than total costs, resulting in profits from growers for around 12% with this price.

Transportation costs from MA are lower than transportation from WA to Central America, with a difference of 22%, favoring Massachusetts growers (Table 4.5). There is no difference between MA and WA regarding destination costs. In addition,

transportation days also are equal from both regions, which are eight days from port to port.

4.3.5.2 Food Marketing Bill

Food marketing includes all activities between production and consumption, for example, assembly, processing, manufacturing, and distribution. On the other hand, the marketing bill can be seen in Table 4.3, for exporting McIntosh apples from the Western Massachusetts to El Salvador, 83.8% of this amount goes to paying the marketing bill to cover the costs of all activities that lie in the middle people's functions. 16.2% amount goes to paying production cost. With this FOB price ($25.10 per 40 pound-bushels), growers could receive profits of nearly 12%.

According to these results, it is profitable for Massachusetts growers to export apples from the Western region to Central America using a FOB price that ranges around $25.10 per bushel, since price is higher than total costs.

Analyzing the entire flow for an apple that is produced in Massachusetts, and estimating the real costs obtained in this study shows that it is profitable for wholesalers and growers. However, it always depends on the growers and wholesaler interests and the economic market role. In conclusion, even when it is profitable at a FOB price of $25.10 which was discovered in this research, growers must analyze their marketing options, as other options may exist that provide even greater profits or lower risks.

4.3.6 Marketing Strategy

4.3.6.1 Small Apples vs. Big Apples

In 2010, a study of Salvadorians consumer preferences was conducted (Alvarado, 2011). This study revealed that the El Salvador fresh apple market have three different size preferences. Apples with sizes from 72 – 100 count are considered large, apples that are 113-150 count are considered medium-sized, and any number per carton higher than 150 are considered small. Of those interviewed, 35% said that they prefer large apples, 34% said they prefer medium apples, and 32% said they prefer small apples. According to standard variety names, 55% buy Delicious, 26% buy Gala, 13% buy Granny Smith, 5% buy Fuji, and 1% buy Golden Delicious. These results indicate that most Salvadorian and Central American consumer prefer apples from 113 counts to 172. This preference could be due to the income levels of the Central America population, family size, and the variety preference could respond to the Washington State apples influence in the Central America Markets since Washington growers are the main supplier.

4.3.6.2 Separate Markets

On the other hand, according interviewed growers and marketers, the United States consumer prefer the bigger apples. This consumers preferences by market, US and Central American, gives an opportunity to New England growers to have a price discrimination strategy in separate markets.

4.3.6.3 Promotion

It is also suggested market apples from 113 and smaller, but in order to introduce McIntosh substantially it is recommended to educate to have consumers' awareness. In addition, it is suggested having a sales person in the target market to take care of costumers and buyers relationship.

4.3.6.4 Price Discrimination

In addition, to market small apples to Central American, this research indicates that Massachusetts wholesalers could be competitive on price for small apples as well, since Boston Market Terminal report prices that range from $13.00 to $18.00 Real Prices "deflated" by the CPI as it can be seen on Table 4.1.

4.3.7 Tables

Table 4.1: McIntosh Wholesale price - Boston terminal market

Location: BOSTON
Commodity: APPLES Report Type: Terminal Market - Wholesale Price
Variety: MCINTOSH

Date/Year	U.S Ex Fancy - 80s - 100s		U.S Fancy 80s - 100s		U.S Fancy 120s - 140s	
	Nominal Price	Real Prices "deflated" by the CPI	Nominal Price	Real Prices "deflated" by the CPI	Nominal Price	Real Prices "deflated" by the CPI
11/10/2013	$ 28.00	$ 28.00	$ 21.00	$ 21.00	$ 18.00	$ 18.00
11/10/2012	$ 41.00	$ 41.60	$ 29.00	$ 29.44	$ 24.00	$ 24.36
11/10/2011	$ 28.00	$ 29.00	$ 22.00	$ 22.80	$ 17.00	$ 17.61
11/10/2010	$ 23.00	$ 24.57	$ 19.00	$ 20.31	$ 16.00	$ 17.10
11/10/2009	$ 25.00	$ 27.15	$ 20.00	$ 21.73	$ 15.00	$ 16.30
11/10/2008	$ 31.00	$ 33.54	$ 22.00	$ 23.82	$ 15.00	$ 16.24
11/10/2007	$ 25.00	$ 28.09	$ 19.00	$ 21.36	$ 16.00	$ 17.99
11/10/2006	$ 30.00	$ 34.66	$ 19.00	$ 21.97	$ 15.00	$ 17.34
11/10/2005	$ 25.00	$ 29.82	$ 17.00	$ 20.29	$ 11.00	$ 13.13
11/10/2004	$ 24.00	$ 29.60	$ 20.00	$ 24.68	$ 11.00	$ 13.57
11/10/2003	$ 20.00	$ 25.32	$ 14.00	$ 17.73	$ 11.00	$ 13.93
11/10/2002	$ 19.00	$ 24.60	$ 11.00	$ 14.25	$ 10.00	$ 12.96
11/10/2001	$ 19.00	$ 24.99	$ 11.00	$ 14.48	$ 10.00	$ 13.16
11/10/2000	$ 19.00	$ 25.70	$ 11.00	$ 14.89	$ 10.00	$ 13.53
Average	$ 25.50	$ 29.05	$ 18.21	$ 20.63	$ 14.21	$ 16.09

Source for wholesale price: United States Department of Agriculture/ Agricultural Marketing Service. Available at www.marketnews.usda.gov
Source for CPI: U.S. Department Of Labor / Bureau of Labor Statistics/ Washington, D.C. 20212 - Consumer Price Index All Urban Consumers - (CPI-U) U.S. city average All items 1982-84=100. It is available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt

Table 4.2: Costs through exporting one commercial container of McIntosh Apples in 2012 from MA to Central America

	Costs	Costs per lb	% Final Price	Costs	Cost per lb	% Final Price	Costs	Cost per lb	% Final Price
	2012			2011			2010		
Wholesale's FOB price	$ 36,260.00	$ 0.93	69%	$ 25,480.00	0.65	48%	$ 23,520.00	$ 0.60	44%
Sea freight and insurance	$ 5,980.00	$ 0.15		$ 5,980.00	0.15		$ 5,980.00	$ 0.15	
Landed Cost	$ 42,240.00	$ 1.08		$ 31,460.00	0.80		$ 29,500.00	$ 0.75	
Import tariff	$ 402.55	$ 0.01		$ 402.55	0.01		$ 402.55	$ 0.01	
Transportation costs		$ 0.16	12%		0.16	12%		$ 0.16	12%
CIF price plus tariff	$ 42,642.55	$ 1.09		$ 31,862.55	0.81		$ 29,902.55	$ 0.76	
Delays' costs	$ 2,307.35	$ 0.06	4%	$ 2,307.35	0.06	4%	$ 2,307.35	$ 0.06	4%
CIF plus cost for delays	$ 44,949.90	$ 1.15		$ 34,169.90	0.87		$ 32,209.90	$ 0.82	
Distributor purchase price	$ 30,909.20	$ 0.79		$ 30,909.20	0.79		$ 30,909.20	$ 0.79	
Total Incomes / losses	$ (14,040.70)	$ (0.36)	-31%	$ (3,260.70)	$ (0.08)	-10%	$ (1,300.70)	$ (0.03)	-4%
Distributor mark-up	$ 6,330.80	$ 0.16	12%	$ 6,330.80	0.16	12%	$ 6,330.80	$ 0.16	12%
Retailer purchase price	$ 37,240.00	$ 0.95		$ 37,240.00	0.95		$ 37,240.00	$ 0.95	
Retailer margin percent	$ 10,838.80	$ 0.28	20%	$ 10,838.80	0.28	20%	$ 10,838.80	$ 0.28	20%
13% (Domestic taxes)	$ 42,081.20	$ 1.07	13%	$ 42,081.20	1.07	13%	$ 42,081.20	$ 1.07	13%
Consumer purchase price	$ 52,920.00	$ 1.35	99%	$ 52,920.00	1.35	100%	$ 52,920.00	$ 1.35	102%

Source: Personal communication with growers, shippers, marketers and consumers (2011, 2012). Invoices obtained throughout each level of the vertical channel from Massachusetts to El Salvador (Nov, and Dec 2012)

Table 4.3: Estimate of the price of a bushel of McIntosh apple from the Western of Massachusetts that is sold in at a supermarket in El Salvador

No.	McIntosh's apple production		Range			Marketing bill	
	Production Costs in Massachusetts 2011-2012						
	Category	**Unit**	**from**	**to**		**Midrange - Cost**	
1	**Cost of production**	Bushel	$ 7.50	$ 10.00		$ 8.75	
	Cost of production - Total		**$ 7.50**	**$ 10.00**		**$ 8.75**	**0.16**
2	**Cost of packing**						
2.1	Packing charges	Bushel	$ 3.00	$ 3.00		$ 3.00	
2.2	Carton	Bushel	$ 2.25	$ 3.50		$ 2.88	
2.3	Smart Fresh charges	Bushel	$ 0.50	$ 0.75		$ 0.63	
2.4	Storage charges	Bushel	$ 0.75	$ 1.25		$ 1.00	
	Sub Total		**$ 6.50**	**$ 8.50**		**$ 7.50**	
3	**Commission charges**	Bushel	$ 1.60	$ 2.50		$ 2.05	
4	**Total Packing costs**	**Bushel**	**$ 8.10**	**$ 11.00**		**$ 9.56**	**0.18**
5	**Total Cost-growers (1+4)**	Bushel	$ 15.60	$ 19.50		$ 18.31	
6	FOB[1] Price	**Bushel**	**$ 25.10**	**$ 25.10**		**$ 25.35**	
7	**Profit - Growers**	**Bushel**	**$ 10.80**	**$ 6.90**		**$ 6.25**	**0.12**
8	**Cost of Transportation**					**$ 5.85**	**0.11**
8.1	Sea Freight and insurance (From MA to El Salvador)	Bushel	$ 5.85	$ 5.85		$ 5.85	
8.2	Import tariff	Bushel	$ 0.40	$ 0.40		$ 0.40	**0.01**
8.3	**CIP - Price for Importer (6+8)**	**Bushel**	**$ 31.60**	**$ 31.60**		**$ 31.60**	
11	**Taxes**	**Bushel**	**$ 4.11**	**$ 4.11**		**$ 4.11**	
	Final Retail price and importer price difference		**$ 22.40**	**$ 22.40**		**$ 22.40**	**0.42**
12	**Consumer price**	**Bushel**	**$ 54.00**	**$ 54.00**		**$ 54.00**	
	Total						**100%**

Source: Personal communication with growers, shippers, marketers and consumers (2011, 2012). Invoices obtained throughout each level of the vertical channel from Massachusetts to El Salvador (Nov, and Dec 2012)

Table 4.4: Substitutes and their prices for apples in El Salvador

Commercial name	Variety	Size (Number of apples per box)	Price per pound (final consumer – Wal Mart) (2010)	Price per Pound (final consumer Super Selectos, 2010)	Price per Pound (final consumer Super Selectos, 2013)
Medium red apple	Red Delicious	From 113 to 150	$ 0.93	$ 0.96	$ 1.38
School red	Red	150	$ 0.76	$ 0.76	$ 1.31
School gala	-	150	$ 0.94	$ 0.94	$ 1.68
Fuji apple	Fuji	100 and 113	$ 1.06	$ 1.19	$ 1.68
Green apple	Granny Smith	113			$ 1.83
Family package red gala apple	Red Delicious and Gala	175	$ 1.58 (6 apples per package)	$ 1.58 (6 apples per package)	
Small red and gala apple	Red Delicious	From 175 to 216	$ 0.64	$ 0.64	

Source: Data from Supermarkets chain in El Salvador in July 2010, and December 2013)**.**

Table 4.5: Transportation Costs from MA and WA State to Central America

United States of America		Washington State	Massachusetts
980	Phytosanitary Certificate	$98.00	$30.10
980	Pallets	$196.00	
1	Temperature recorder	$30.00	$30.00
980	Bunker	$686.00	$800.00
1	Inland Freight	$2,000.00	$231.00
1	Ocean Freight	$3,767.00	$3,712.00
1	Inspection	$542.00	$900.00
		$7,319.00	**$5,703.10**

Source: Prices for Washington provided by Walmart El Salvador, 2010, and prices for Massachusetts obtained by exporting apples from MA to Central America. Alvarado, 2012

4.4 Discussion

As stated in the above sections, the major goal of this study was to enhance the opportunities to market McIntosh apples in Latin America. As a starting point to evaluate the feasibility of the opportunities that Latin American countries offer to the New England Apple Industry, another goal was determined. This goal was to find out the price for the long-term success of exporting McIntosh apples to Central American markets. Determining the price would provide the information necessary to know if it is profitable to export apples to Central America from New England. Finally, this study assessed its hypothesis which states, "if Central American consumers accept McIntosh, Massachusetts apple growers could export to Central America profitably."

In order to verify this hypothesis, several steps were taken into consideration. Since the 2012 apple season, the FOB McIntosh prices were higher domestically than the FOB price that buyers were willing to pay in Central America, giving a result that did not favor the profits of the apple growers if they had exported to Central America in 2012 only (Figure 4.1). However, it was found that the FOB price of $26.40 per bushel, which was discovered by this research, is profitable for New England growers. This discussion aims to analyze these results by understanding some data of the apple industry and considering what was observed during the research process of exporting apples from Massachusetts. The main sections are organized as follows. Section1 describes the markets and trade for fresh apples. Section 2 presents the main findings during the research. Section 3 is an analysis of the market structure for fresh apples in Central America. Section 4 presents future endeavors to be considered in the academia media for these topics.

4.4.1 Markets and Trade for Fresh Apples

4.4.1.1 World Apple Industry

China is the world's largest producer at 35.8 million tons. The World Apple Report, (2011) informs that China is the greatest Apples country grower, 60 percent of the global production. According to this report this production is due the efficient orchard management, greater government incentives, and continued area expansion in western provinces" (World Apple Report: Record China Production; (n.d)). According to the Foreign Agricultural Organization (FAO 2011), EU continues to be the second largest producer with 11.3 million tons for 2012. In addition, FAO (2011) states that EU remain the world's largest exporter, with Russia as a major market. In 2008, the United States produced 7.5% of world production, 3.8% less than 2012.

4.4.1.2 U.S.A. Apple Industry

Until 2011, U.S. apple production was practically unchanged from previous years at 4.2 million tons based on recent industry data. However, in 2012, there was an increase in the apple supply, particularly for fresh use. According to World Apple Report (n.d.), this growing was due to the large harvesting in Washington State and the reduced crops from the Central and Eastern states, which were damaged by the 2012 spring. On the other hand, in 2012/2013, the fresh apple domestic consumption was estimated at 2.2 million tons in U.S., while imports were unmoved at 175,000 tons. However, The World Apple Report (n.d.), also claims that apple exports climbed 14% percent, due mainly by increasing demand from Asia, Middle East, and Central America. Neighboring Canada and Mexico remained the main markets (USDA, 2013).

In the United States, statistics show that Apples are grown commercially in 36 states. In 2012, six states accounted for 92% of the U.S. apple crop: Washington (72%), New York (8%), Michigan (1%), California (3%), Pennsylvania (5%), and Virginia (3%); 29 other states represent 8%, Massachusetts, among them. Utilized apple production for 2012 was estimated at 8.99 billion pounds, down 3 percent from 2011. According to USDA (2013), New York's apple growers informed that their crop was negatively impacted in 2012 by early warm weather in March, which provoked early development, followed by freezing in April and drought conditions in June and July. USDA (2013) also reported that the 2012 Michigan apple crop was drastically diminished from a series of severe frosts in April. However, Washington apple growers did not report losses.

4.4.1.3 U.S. Apple Exports Worldwide

For 2012, U.S. apples exports to all countries totaled $1.07 billion, up 14% from 2011 and 30% higher than 2010. Among the total amount exported, Washington State represented 82% of this total, up 4% from 2010. As Washington state exports grow, the exports of apples from Massachusetts have fallen. For example, in 2012, Massachusetts exported a value of $379,754, which was 32% less than 2010, ($564,289), which was much less than 1% of the total U.S. exports of apples. In 2009, Massachusetts exported $736,572 of apples, 30% more than in 2010. Similarly, 2008 exports were $881,256, 56% more than 2010 exports. Each year since 2008, the Massachusetts apple industry has decreased its apple exports (Bureau and Commerce, 2013).

4.4.1.4 Apples Industry in the Central American Region

The FreshFruitPortal.com (2012) reported that in 2011, according to the Ministry of Agriculture of Chile, Central America and the Caribbean imported the largest

number of apple varieties from USA and Chile. In other hand, the Secretary of Central American Economic Integration's (Integration Central American Economic, (2013) records show that apple imports have increased considerably in Central America since 2008, jumping from a value of US$53.2 million to $69.5 million in 2012, 31% growth (FreshFruitPortal.com (2012)).

In 2012, Costa Rica leads apple imports in Central America, at US$19.8 million, followed by Guatemala at US$15.9 million, Honduras at US$15.1 million, and El Salvador at US$13.4 million. According to the Ministry of Chile and mentioned in the FreshFruitPortal.com Costa Rica is also the number one importer in Central America of Chilean apples. However, Honduras is the number one importer in Central America of US apples following by Guatemala and El Salvador (FreshFruitPortal.com (2012). According to SIECA data, in 2008, Chile was the main apple supplier in Central America, a position taken by the USA since 2009 (FreshFruitPortal.com (2012)).

4.4.2 Analysis of the Main Findings during the Research Performance

4.4.2.1 The Massachusetts Apple Growers

According to different national sources of the apple industry, including reports and testimonies of apple growers, the Massachusetts apple growers have been facing several problems for the past 20 years. One of the difficulties that affects the apple industry in Massachusetts and New England is the production costs, which is significantly higher than the costs of production of the other major apple growing regions of the United States. In addition to this situation, the amount of acres produced in the Massachusetts is significantly smaller than those in Washington, Michigan, California, Oregon, and New York (Figure 4.2). Additionally, the yield per acre in New England is

much less than the average yield nationally (Figure 4.7). This point is important for this research, because those states have long been exporting apples to the Central America region and are the main competition of New England growers in those countries.

By having those States as main suppliers of the apples from United States in Central America (Figure 4.3) results in another problem for Massachusetts apples growers. This problem is the influence of the main growth varieties from those states in the Central America apple market, including Delicious, Gala, Fuji, and Granny Smith. These varieties are the most consumed in that region (Figure 4.6). However, consumers are not dependent on these varieties yet and are open to new varieties, such as McIntosh. Therefore, McIntosh provides an opportunity for apple growers in New England. New England is a major producer of McIntosh in the United States, and it has been accepted by Central American Consumers (Alvarado, 2011).

4.4.2.2 Apple Season 2012 in New England

As it was stated above, high production costs of apples in New England makes the average price in New England higher than the average price of the domestic market. This is a disadvantage for apple growers in Massachusetts compared to growers or cooperatives that are exporting to the Central American market. Additionally, apple orchards in Massachusetts and the New England area suffered severe damage in the spring of 2012, which affected the supply of apples. On the other hand, one of the largest apples growing states in the eastern US is Michigan, which also suffered extensive damage in the 2012 spring, causing its apple production to decrease considerably in yield per acre (Figure 4.7). As a result of this situation, the apple prices increased by more than

42% compared to 2011 (Figure 4.8). This situation drastically affected the results of this study regarding the apple price in Central America.

In New England, for 2011, the wholesale price for McIntosh was $ 0.60 cents per pound, and in 2012, the wholesale price for McIntosh apple was $ 0.92 cents per pound. Speaking in terms of international trade, the FOB price in Massachusetts was $ 37.00 per box of 40 pounds of apples. This price was $ 4.00 dollars higher than the CIF price that Central American paid, which was $ 33.00. In conclusion, the first factor influencing these results was the disparity in wholesale price as a result of the 2012 apple season in Massachusetts and New England, and the price of apples in Central America.

In other words, in 2012, the Massachusetts and New England area supply went down, resulting in a higher price for this region, but the price in other regions stayed the same. Therefore, it was difficult for New England growers to sell apples at a competitive price in Central America when they could sell them locally for a much higher price.

4.4.2.3 Apple Exporting from Massachusetts

During the process to export apples to Central America, it was difficult to obtain apples from different growers and wholesalers. As it has been mentioned, this difficulty was due to last apple season, which affected the growers in New England. There were few apple orchards which were willing to export apples to Central America.

According to this research, the main factors that apple growers saw as difficult in exporting to this new market were: 1) Central America is an unknown market for them since they have never exported to those countries; 2) There are few wholesalers who have the facilities to pack high quality apples for export, and few apple growers are prepared to manage high-quality fruit for long-distance marketing, including the use of Smartfresh

technology, controlled atmosphere rooms, and other best handling practices; 3) Growers or wholesalers who have packing facilities, CA rooms, administrative procedures for exporting have a recognized domestic market and do not see the Central America Region as an option yet; 4) Lack of supply in the last 3 years did not encourage apple growers to make this new path of exporting apples to Central America (Figure 4.9), and 5) In addition to the lack of supply, growers are afraid of different currencies that Central America has in some countries, except El Salvador whose currency is the USA currency, and growers believe that it could affect their revenues.

Despite these factors, there are some apple wholesalers who still see an opportunity in those markets. This opportunity is attractive when there is too much supply in the New England region, especially for small and medium-sized apples, the preference of Central American consumers (Alvarado, 2011). Finally, the decision to export apples from Massachusetts to Central America is always attractive if there are significant earnings as a result of this movement.

Throughout the processing of paperwork, there were no significant obstacles presented by the US Government, but this was not the case for the Salvadoran government.

4.4.2.4 Market Structure for Apples in Central America

Central America is being dominated by three firms that are the largest and account for more than 70% of the total apple sales in Central America. As a result, the Central America apple market behaves like an oligopoly. This means that they compete on things other than price, spending large amounts of money advertising, packaging, and other marketing strategies. This situation makes the introduction of a new apple variety

more difficult because of some difficult barriers to entry, at least when apple growers negotiate directly.

One barrier to entry is the local government, which delayed inspection by El Salvador's Customs. This caused that the CIF price to increase significantly because of the cost of the container and the need to keep it refrigerated. Further, the negotiation process was not fully transparent. The supermarket where the apples were sold hired a local distributor and that distributor did not use the best handling practices for McIntosh apples. This mishandling may have been due to lack of knowledge, or it could have been intentional.

The utilization of marine transport in this project was efficient. Shipping time from Massachusetts to Honduras was only 8 days and did not compromise apple quality. Further, the cost of shipping a refrigerated container with a capacity of 980 40-pound boxes was 33% cheaper than comparable transport from Washington State to El Salvador.

The most important concern regarding exporting apples is how people in Central America handle them. To avoid variety potential problems, it is recommended that growers or brokers negotiate a FOB price where the importer takes the risk in Central America. It is also proposed to work with supermarkets with a good reputation and all facilities needed maintain apple quality. Another barrier to enter to Central America is how the competition reacts when new varieties enter the marketplace. In addition, another important barrier to entry is the rising crime rate which is affecting many businesses in Central America.

Generally speaking, it could be concluded that there are few barriers to enter to the apple market, but competition could force an exit from the market since a small number of firms have market power and have high market share. Despite, this situation there are opportunities in terms of unmet consumer needs.

4.4.2.5 McIntosh Apple Sales Analysis in El Salvador

Once El Salvador Customs inspected the apples, they were delivered to the distribution center. Once in the distribution center, the apples were inspected by people who work for the supermarket, and they were accepted as high quality apples. One day following; the apples were delivered to the different supermarkets in small amounts. However, according to what was recorded, the apples were stored at 13° Celsius, and the bigger apples became softer and bruised easily. Consequently, these softer apples with small bruises were sold to the informal market. Due to apple mishandling, these apples were sold cheaper than the apples that kept their quality throughout the entire chain from Massachusetts to the consumers in Central America. The apples that were sold in the supermarkets were seen as high quality apples. The supermarket priced them at $ 1.35 per pound, the same price as other varieties from other locations. After two days, all 386 boxes were sold. The obvious popularity of McIntosh as seen from these results is in accordance with the market analysis conducted by Alvarado (2011).

4.4.3 Key factors to be considered to export apples from Massachusetts to Central America markets

4.4.3.1 Support from the U.S Government to the New England Apple industry to reach those attractive markets niches

In order to start exporting commercially to Central America from New England, it is advisable to be supported by a state program for at least the first two shipments to

overcome difficulties of logistics costs, culture, and language that might arise. There is a program that is supporting apple promotion and trade relations between Central America and the United States. However, this program is headquartered in Mexico. This situation is not conducive to promote business in Central America, because, although both regions speak Spanish, there are differences in culture, consumer preferences and habits, government issues, and poverty index.

4.4.3.2 Firms

It is recommended to start negotiating with firms that have a good reputation in the marketplace and to hire a sales person that represents the New England apple growers' interests in Central America.

4.4.3.3 Crime Rates

El Salvador, Honduras and Guatemala are countries with high crime rates. For example, it is reported that, in El Salvador, l4 people are murdered per day. Additionally, robberies, assaults, and almost no respect for human life has turned the region into a danger zone. These factors must be kept in mind when undertaking business. A 2013 study on gun violence sponsored by the United Nations Organization (UN) reported that Honduras ranks as the most violent country in the world with a crime rate of 84 homicides per 100,000 inhabitants, and 22 murder per day. In addition, the same study claimed that Guatemala ranked among the 14 most violent countries in the world.

4.4.3.4 Political Instability

Politically, El Salvador, Honduras and Guatemala are quite unstable and have a high rate of corruption, endangering the good performance of laws in those countries. These countries also have become home for the most dangerous drug runners in the

Americas. However, the vast majority of their population is hardworking, honest and wish to have a life without violence, with job opportunities, as was the case 10 years ago.

4.4.3.5 Demand Preferences

In order to position McIntosh apples in Central America, it is suggested to export McIntosh apples along with other varieties that are already known in Central America.

It is necessary that apple growers analyze in depth the opportunities that these markets are offering. Overall, Central America has few entry barriers, with a consumer market growing considerably, and offers a niche market for small to medium sized apples that have little domestic value. This could be an important opportunity to consider.

The apple business is a good option for both New England apple growers and the Central America middleman, but like any other business, it should be analyzed by the New England Apple Industry to take into account the pros and cons.

4.5 Conclusions

To be successful and remain successful in the international marketplace, it is important to analyze and to understand the complex international trading environment.

In terms of the exporting process for fresh produce from Massachusetts, there is not specific information that can be utilized by the industry. However, according to what was identified through this research, the first step is to have buyers and sellers who are interested in doing business. This is a result of previous work that involved many visits to El Salvador to conduct market research and create relationships with buyers to promote McIntosh apples and to become familiar with the country economic and political conditions. After buyers and sellers agree on the product that will be exported and it meets the consumers' needs, then the export process starts. Thorough this research, the

following main activities, were identified which are part of the export process for agricultural products.

- Marketing research in the country of interest
- Determination of the target Market
- Analysis of the market structure of the industry
- Long-distance best handling practices for the commodity along the supply chain
- Determine the term of sale
- Contract of affreightment
- Clear understanding of the logistics management along the supply chain
- Grading and packing according to the International Standards for each commodity
- Inspection to obtain phytosanitary permission and export of certificate
- Coordinate with buyers to have a certificate of origin
- Inspection of the produce in the country customs of destination
- Determine the facilities and strategy to distribute the produce in the country of destination
- Assistance to the final consumers to follow up the finals sales

All of these activities include a clear communication and understanding of the exportation and marketing process. The major topics of importance at the moment of the negotiation are; the term of sale, the documentation, required at the time of exporting, and knowledge of industry standards of products to be exported.

In terms of the marketing mix, and since this project is to export McIntosh apples, which is the product being introduced to Central America. According to Alvarado, 2011

this apple has the right features that Central American consumers prefer. However, there was no information about the price that consumers would pay for McIntosh apples. Consequently, there was no thought given the process of the marketing mix.

Regarding the place and specific location in Central America, this varies greatly. There are many marketing channels, from very low in technology to those with the highest technologies to maintain high quality on apples, which is the case for this study. One of the characteristics of Central America is that few firms have high technology to handle apples. These firms resell the apples to different vendors who bring the product to consumers; however, most of these vendors are informal and with little knowledge of best handling practices.

Regarding promotion, there is no specific information about how firms are promoting apples to reach their target market. However, there are many marketing strategies to promote apples. For example, today, the media plays a very important role to bring products to consumers, there also many websites where consumers can find apple recipes, apple varieties, apples growers associations, and places where they can buy and order online. Internationally, there are few promotional campaigns to promote apples from United States to Central American consumers. One of the most recognized is the Washington State Apple Association, which has a website to promote their apples in Spanish. In addition, there are some professionals who are working to promote apples directly and represent the apple industry interest from the United States.

According to what experts suggest, even when there is an appealing promotional strategy, if is not accompanied by the right price and the right quality, the right place it is not enough to succeed in the market. In Central America, buyers said that fresh apples do

not need much promotion to get consumers. However, when a new variety is introduced, marketers promote it by conducting tastings in their outlets and promoting the new variety in the Newspapers.

4.6 Figures

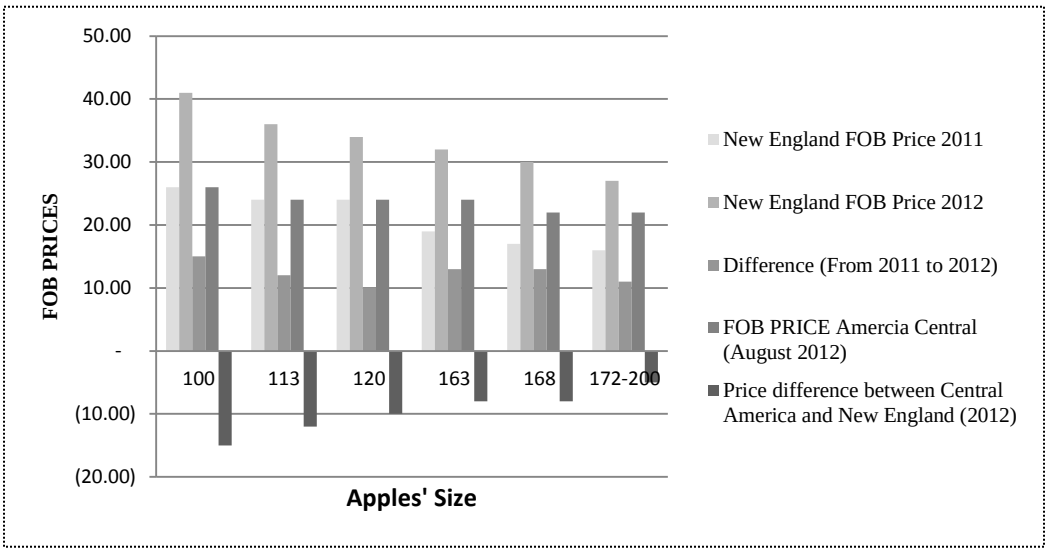


Figure 4.1: FOB Price difference between New England and Central America and New England Region by apple size. Source: Interviews with growers, wholesalers, buyers and marketers by Mildred Alvarado, 2012.

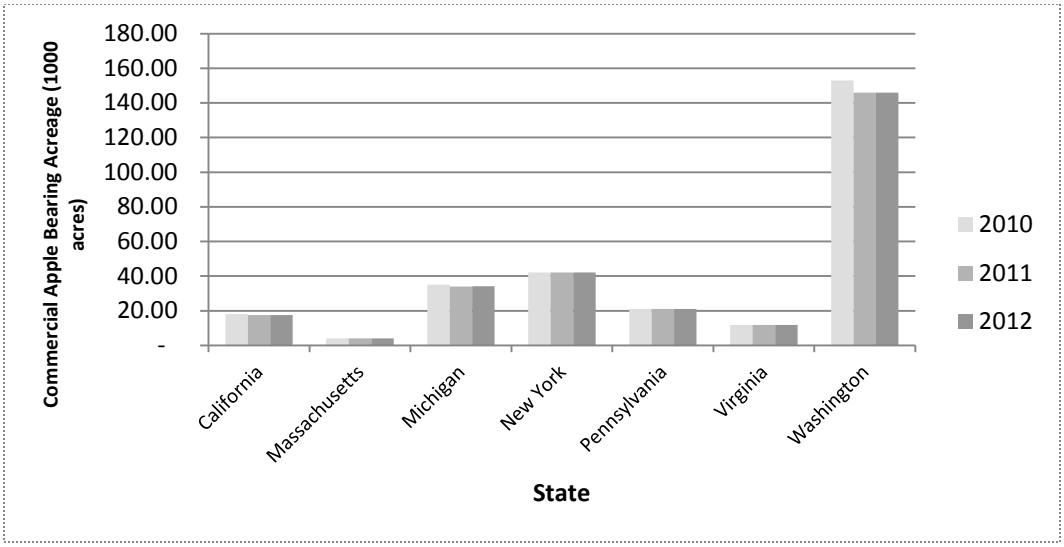


Figure 4.2: Commercial apples: bearing acreage. Source: Non-citrus Fruits and Nuts 2013 Summary: Released July 7, 2013. (National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S Department of Agriculture 2010) www.nass.usda.gov

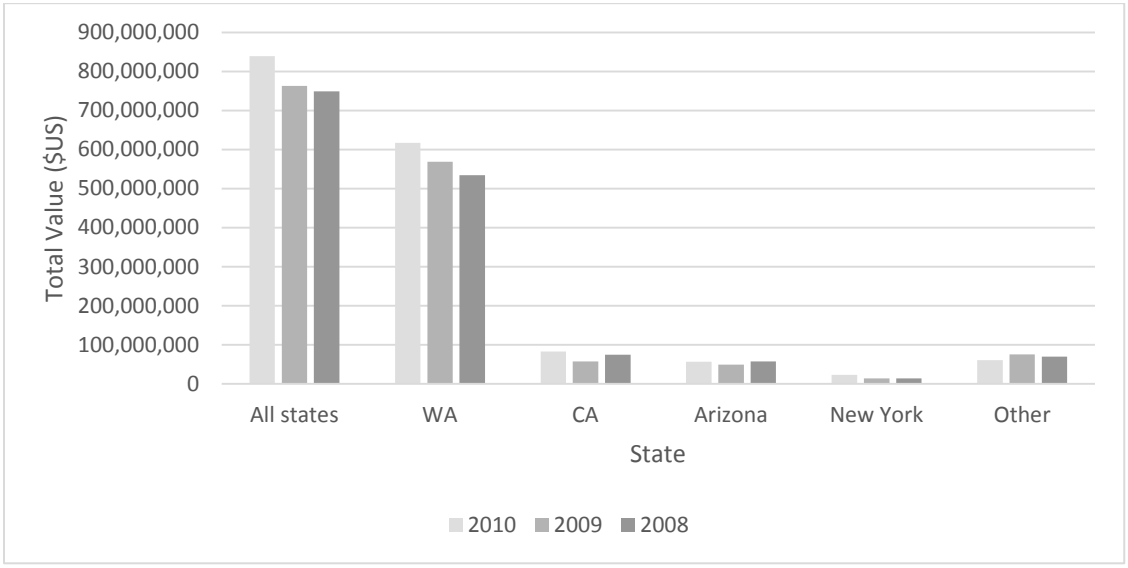


Figure 4.3: Apple exports from the US to Central America (2005-2010). Source: Department, U.S Census Bureau, Foreign Trade Statistics. U.S. Export Data

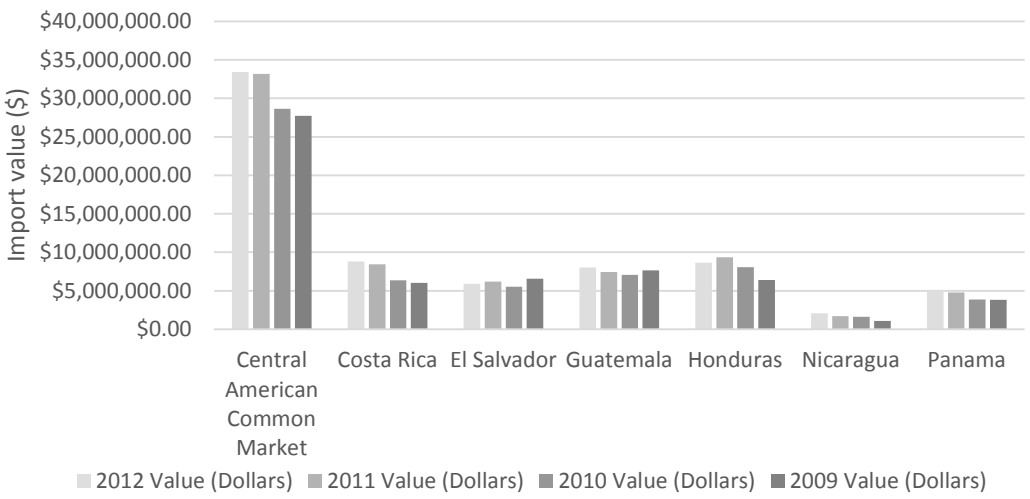


Figure 4.4: Apples imported from U.S.A to the Central American Common Market (2009-2012), Source: Sistema de Integracion Economica de Centro America, www.estadisticas.sieca.int

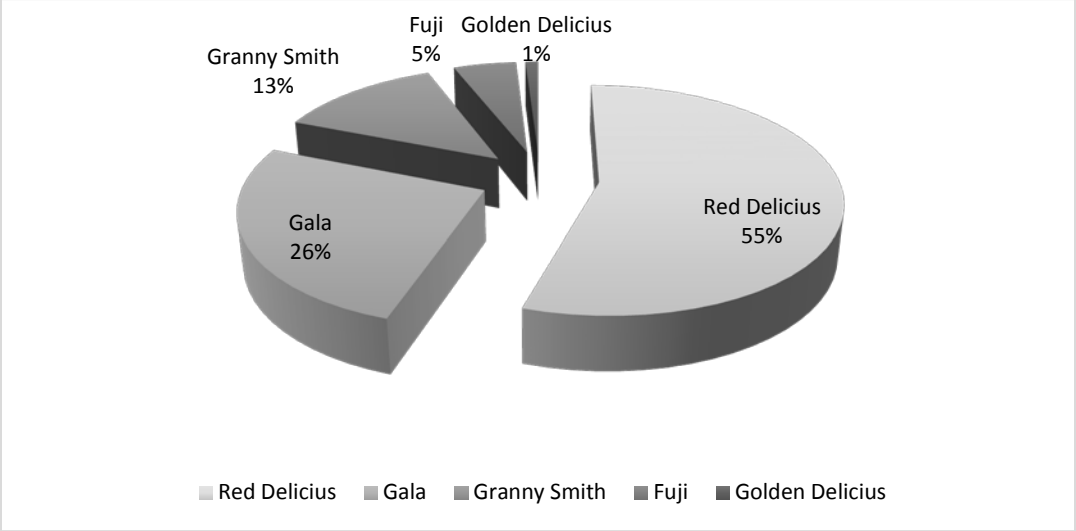


Figure 4.5: Apples imported from U.S.A to the Central American Common Market (2009-2012), Source: Sistema de Integracion Economica de Centro America, www.estadisticas.sieca.int

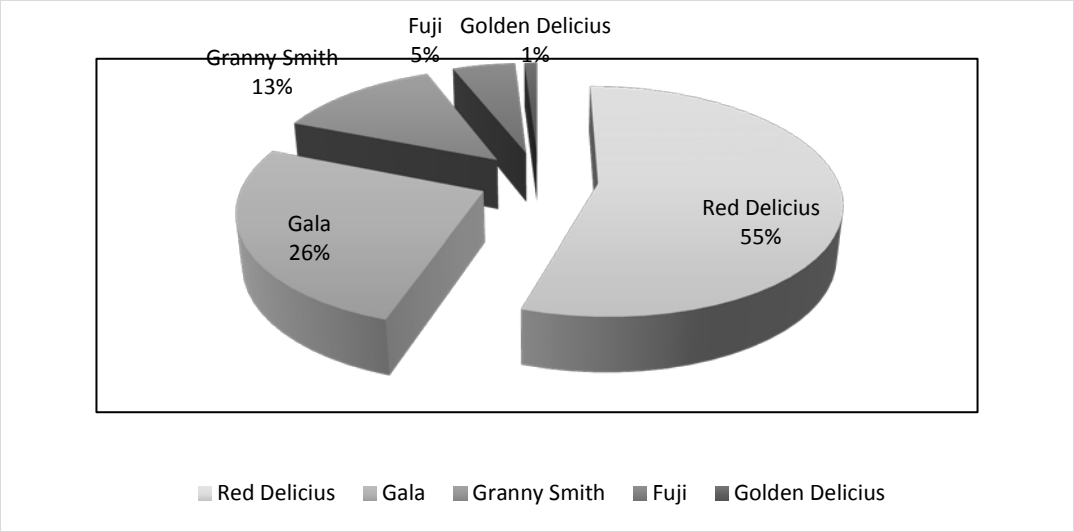


Figure 4.6: Apples varieties preferences in Central America. Source: Analysis of the Market, Alvarado, 2011

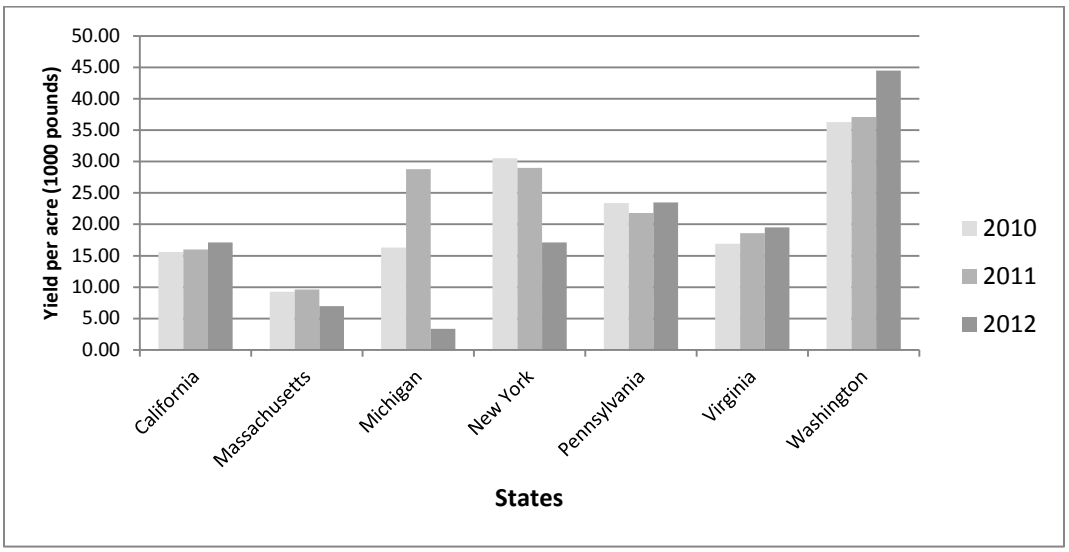


Figure 4.7: Commercial apples: yield per acre. Source: Non-citrus Fruits and Nuts 2013 Summary: Released July 7, 2013. (National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S Department of Agriculture 2013) www.nass.usda.gov

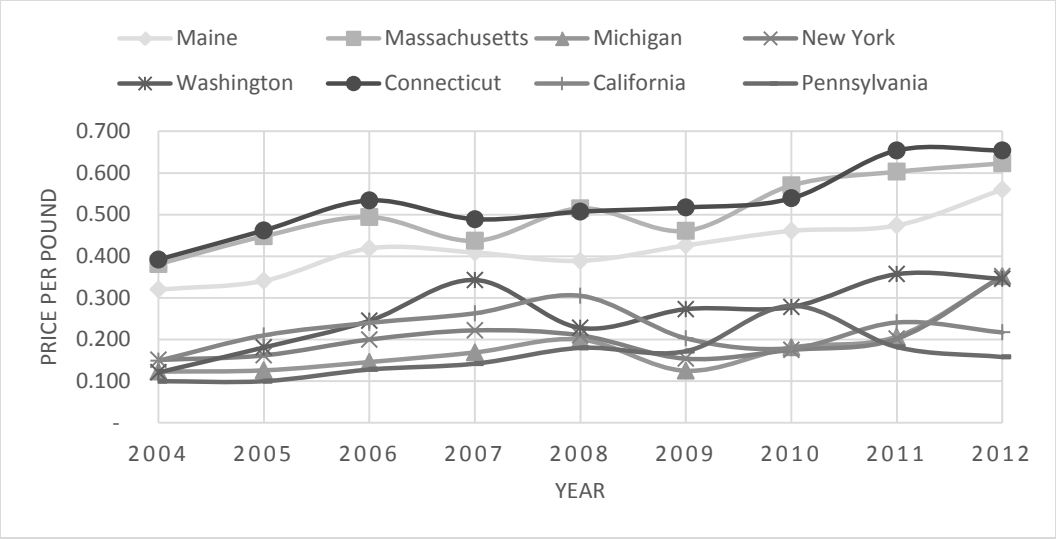


Figure 4.8: Commercial apples: price per pound. Source: Non-citrus Fruits and Nuts 2013 Summary: Released July 7, 2013. (National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture 2013) www.nass.usda.gov, Source: www.nass.usda.gov

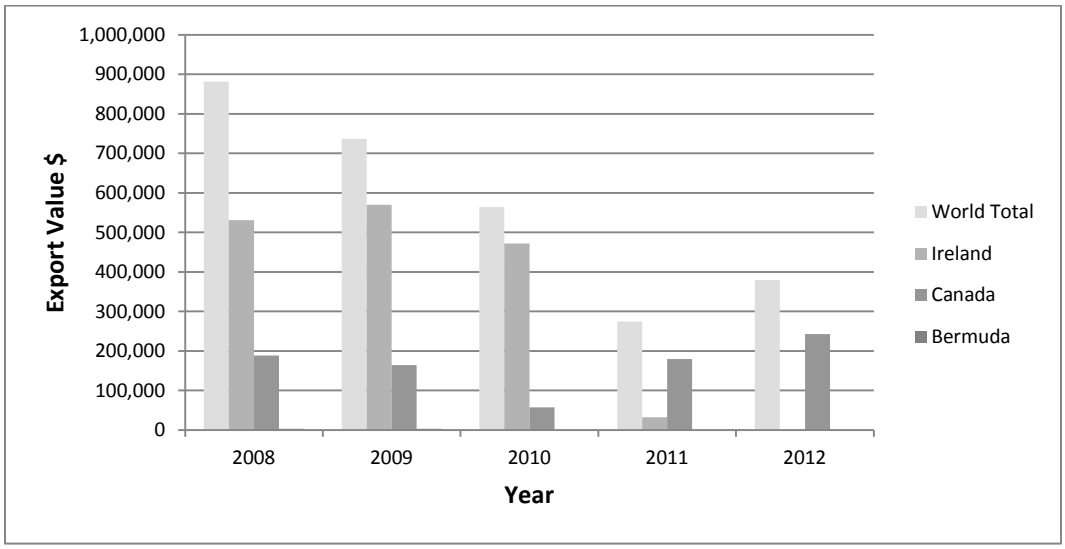


Figure 4.9: Fresh apple export from Massachusetts State. Source: Food Export Midwest-Northeast, www.foodexport.org

FUTURE ENDEAVORS

Even when apples have been one of the fruits more studied globally, especially in apple growing countries, research is still needed relative to marketing, particularly in regions where apples are not grown locally and hence must be imported. It is necessary to study marketing issues in these countries in order to support the exporting apple industry's desires to reach international markets. One step in addressing these markets is to develop strategies and appropriate technology that can help maintain fruit quality in apple-consuming countries. It also would be interesting to study consumer preferences in those countries and to select or develop new varieties that meet consumer needs and that keep high quality even when handling is less than ideal. For example, according to some sources in El Salvador, 80% of the apples are sold through the informal market using almost no temperature control.

As a continuation of the current research, more trial export needs to occur. Two full containers exported from New England to Central America would help further enhance the understanding of logistical, cultural, and political issues. Further, additional New England varieties should be a trial marketed in Central America.

The positive response of Central American consumers to McIntosh apples has increased the interest of the New England Apple Industry. However, it is necessary to work with apple growers in New England to educate about exporting apples. The Central America Free Trade Agreement (CAFTA) was enacted in 2005 between Central America and the United States. This agreement promotes free trade between the US and Central America and enhances the potential benefits of selling Massachusetts apples in Central

America. However, there is no information how CAFTA has benefited the New England apple growers, making it an important area for future research.

APPENDIX 1

EXPORT DOCUMENTATION

USDA

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
FRUIT AND VEGETABLE PROGRAMS
EXPORT FORM CERTIFICATE

X- 032604-5

Inspection Started (M M D D Y Y)	11 09 12
Inspection Completed (M M D D Y Y)	11 09 12

WARNING: *Any person who knowingly shall falsely make, issue, alter, forge, or counterfeit this certificate, or participate in any such actions, is subject to a fine of not more than $1,000 or imprisonment for not more than one year, or both*

APPLICANT/SHIPPER: WORLD FARMERS INC. CITY/STATE: LANCASTER, MA

RECEIVER: CITY/STATE:

CARRIER ID: PU NO.: [ ] [X] USDA FEDERAL STATE INSPECTED 117 MA-001

CERT./WORKSHEET NUMBER:

PRODUCT	NUMBER & TYPE OF CONTAINERS	DESCRIPTION OF PRODUCT (BRAND, VARIETY, SIZE, ORIGIN, etc.)	GRADE
Apples	157 TRAY PACK CARTONS	EASTERN APPLES - McIntosh 80, 100, and 125 Count	U.S. NO. 2
Apples	37 TRAY PACK CARTONS	EASTERN APPLES - Mutsu 48, 56, and 80 Count Packed by UMASS Cold SPRING Orchards 391 SABIN STREET, Belchertown, MA 01007	U.S. NO. 2
Apples	245 CELL PACK CARTONS	CARLSON ORCHARDS - McIntosh 88 and 120 Count CARLSON ORCHARDS INC, HARVARD, MA 01451	U.S. EXTRA FANCY

THIS IS TO CERTIFY THAT THE [ ] APPLES [ ] TABLE GRAPES

IN THE ABOVE IDENTIFIED LOT(S) HAVE BEEN INSPECTED AT THE PLACE AND DATE STATED ABOVE, AND FOUND TO MEET THE REQUIREMENTS OF THE:

[ ] EXPORT APPLE ACT [ ] EXPORT GRAPE AND PLUM ACT

[ ] EXPORT GRAPE AND PLUM ACT except for export to destinations in Europe, Greenland, or Japan

REMARKS: ALL Lots: Produce of U.S.A.

EXPORT FORM CERTIFICATE

FOR USDA USE ONLY

CORRECTS FV-207 CERT. NUMBER:

APPLICANT NO.: 21

I, the undersigned, a duly authorized inspector of the United States Department of Agriculture, do hereby certify that samples of the herein described product were inspected and the grades as shown by said samples were as herein stated

INSPECTOR'S SIGNATURE: Robert Gradea DATE ISSUED: 11-9-12

Issuing Office: Boston, MASSACHUSETTS

FEE: $ 30.73
OVERTIME: —
EXPENSES: —
ESTIMATED TOTAL: $ 30.73

CWT	ON-SITE HOURS	OT(hours)
INSPECTED BY	TRAVEL MILES	OT(hours)
	OTHER FEES $	

Information listed below is furnished by applicant/packer and is not the responsibility of the USDA Inspection Service

VESSEL	VOYAGE NO.	CONTAINER NO.

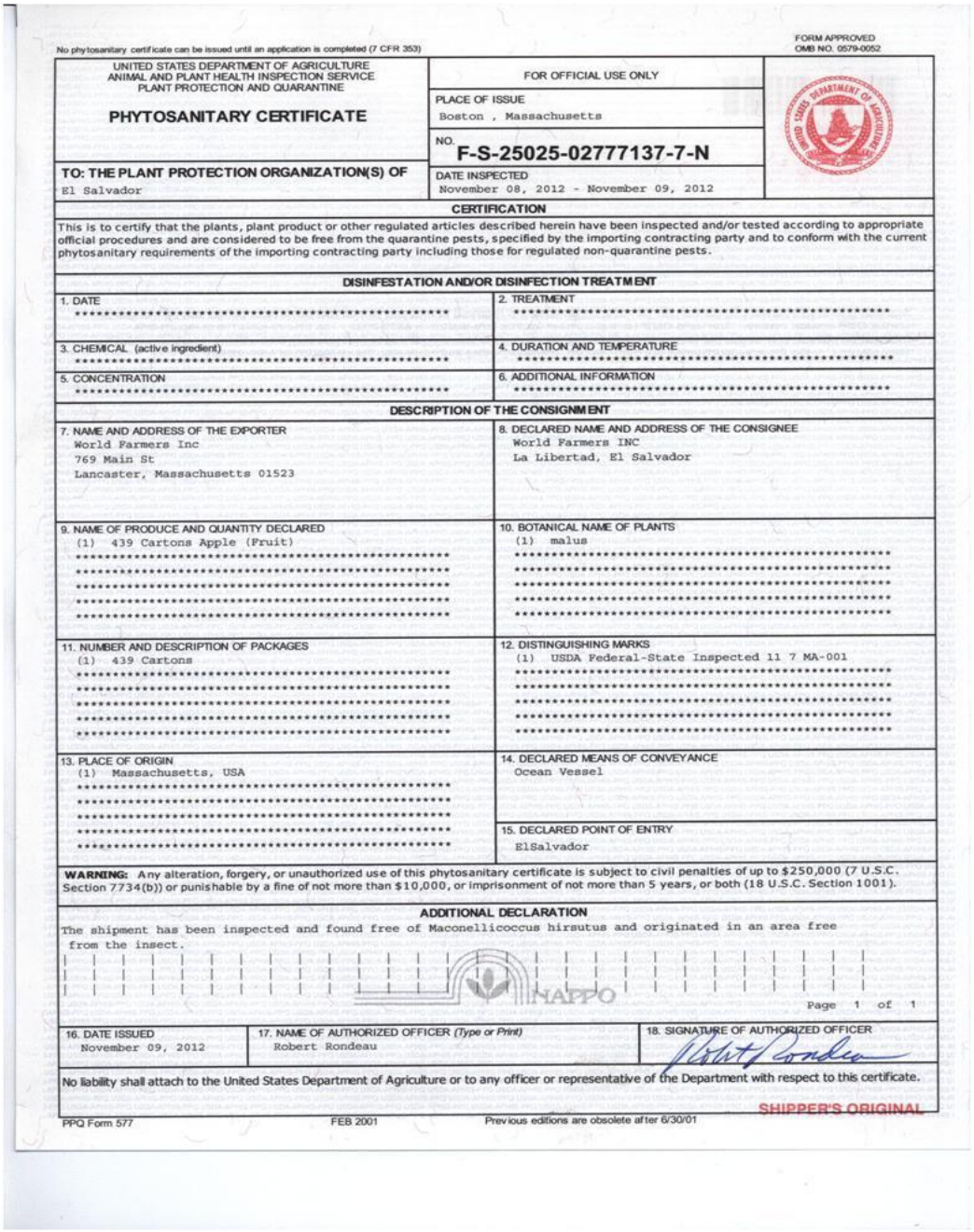
OTHER RELEVANT SHIPPING INFORMATION

AUTHORIZED REPRESENTATIVE

FORM FV-207 (01/07)

ORIGINAL / APPLICANT

A1.1: Export Certificate



No phytosanitary certificate can be issued until an application is completed (7 CFR 353)

FORM APPROVED
OMB NO. 0579-0052

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

PHYTOSANITARY CERTIFICATE

FOR OFFICIAL USE ONLY

PLACE OF ISSUE
Boston , Massachusetts

NO.
F-S-25025-02777137-7-N

DATE INSPECTED
November 08, 2012 - November 09, 2012

TO: THE PLANT PROTECTION ORGANIZATION(S) OF
El Salvador

CERTIFICATION

This is to certify that the plants, plant product or other regulated articles described herein have been inspected and/or tested according to appropriate official procedures and are considered to be free from the quarantine pests, specified by the importing contracting party and to conform with the current phytosanitary requirements of the importing contracting party including those for regulated non-quarantine pests.

DISINFESTATION AND/OR DISINFECTION TREATMENT

1. DATE	2. TREATMENT
3. CHEMICAL (active ingredient)	4. DURATION AND TEMPERATURE
5. CONCENTRATION	6. ADDITIONAL INFORMATION

DESCRIPTION OF THE CONSIGNMENT

7. NAME AND ADDRESS OF THE EXPORTER	8. DECLARED NAME AND ADDRESS OF THE CONSIGNEE
World Farmers Inc 769 Main St Lancaster, Massachusetts 01523	World Farmers INC La Libertad, El Salvador
9. NAME OF PRODUCE AND QUANTITY DECLARED	10. BOTANICAL NAME OF PLANTS
(1) 439 Cartons Apple (Fruit)	(1) malus
11. NUMBER AND DESCRIPTION OF PACKAGES	12. DISTINGUISHING MARKS
(1) 439 Cartons	(1) USDA Federal-State Inspected 11 7 MA-001
13. PLACE OF ORIGIN	14. DECLARED MEANS OF CONVEYANCE
(1) Massachusetts, USA	Ocean Vessel
	15. DECLARED POINT OF ENTRY
	ElSalvador

WARNING: Any alteration, forgery, or unauthorized use of this phytosanitary certificate is subject to civil penalties of up to $250,000 (7 U.S.C. Section 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. Section 1001).

ADDITIONAL DECLARATION

The shipment has been inspected and found free of Maconellicoccus hirsutus and originated in an area free from the insect.

NAPPO

Page 1 of 1

16. DATE ISSUED	17. NAME OF AUTHORIZED OFFICER *(Type or Print)*	18. SIGNATURE OF AUTHORIZED OFFICER
November 09, 2012	Robert Rondeau	Robert Rondeau

No liability shall attach to the United States Department of Agriculture or to any officer or representative of the Department with respect to this certificate.

SHIPPER'S ORIGINAL

PPQ Form 577 FEB 2001 Previous editions are obsolete after 6/30/01

A1.2: Phytosanitary Certificate

Tratado de Libre Comercio entre Centroamérica, Republica Dominicana y los Estados Unidos

Certificado de Origen

(Instrucciones anexas)

1. Nombre y domicilio del exportador: **WORLD FARMERS INC** **769 MAIN ST, PO BOX 112 LANCASTER, MA 01523** **TEL. (413) 658-4279**	2. Periodo que cubre: D M A D M A Desde: 01/01/2012 hasta: 31/12/2012			
3. nombre y domicilio del productor: **WORLD FARMERS INC** **769 MAIN ST, PO BOX 112** **LANCASTER, MA 01523** **TEL. (413) 658-4279**	4. Nombre y domicilio del importador: Número de Registro Fiscal: 219309-0			
5. Descripción del (los) bien(es)	6. Clasificación arancelaria	7. Criterio para trato preferencial	8. Productor	9. País de Origen
MANZANAS	080810	**A**	**SI**	**USA**
10. Observaciones:				
11. Declaro bajo protesta de decir verdad o fe de juramento que: - Los bienes son originarios del territorio de una o más de las Partes, salvo lo establecido en los párrafos 10(a), 11(a) o 12(a) del Anexo 3-04(5) del Tratado, cumplen con los requisitos de origen que les son aplicables conforme al Tratado y no han sido objeto de procesamiento ulterior o de cualquier otra operación fuera de los territorios de las Partes, salvo en los casos permitidos en el artículo 6-17 del Tratado. - La información contenida en este documento es verdadera y exacta y me hago responsable de comprobar lo aquí declarado. Estoy consciente que seré responsable por cualquier declaración falsa u omisión hecha en o relacionada con el presente documento. - Me comprometo a conservar y presentar, en caso de ser requerido, los documentos necesarios que respalden el contenido del presente certificado, así como a notificar por escrito a todas las personas a quienes entregue el presente certificado, de cualquier cambio que pudiera afectar la exactitud o validez del mismo. Este certificado consta de ____1__ hojas, incluyendo todos sus anexos.				
Firma del exportador: *Maria C Moreira*	Empresa: **WORLD FARMERS INC**			
Nombre: **Maria c Moreira**	Cargo: **Directora**			
Fecha: D M A **13/11/2012**	Teléfono: Fax : (413)658-4279			

A1.3: Origen Certificate

THE COMMONWEALTH OF MASSACHUSETTS

EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS

Department of Agricultural Resources
251 Causeway Street, Suite 500, Boston, MA 02114
617-626-1700 fax: 617-626-1850 www.mass.gov/agr

MDAR
MASSACHUSETTS DEPARTMENT OF AGRICULTURAL RESOURCES

DEVAL L. PATRICK, Governor | TIMOTHY P. MURRAY, Lieutenant Governor | RICHARD K. SULLIVAN JR., Secretary | GREGORY C. WATSON, Commissioner

CERTIFICATE OF FREE SALE

Applicant: World Farmers Inc.
Address: 769 Main Street, PO Box 122
Lancaster, MA 01523

Date: November 9, 2012

The Applicant named above has requested from the Massachusetts Department of Agricultural Resources a "Certificate of Free Sale" with respect to those products and commodities listed below, certifying that to the best of the Department's knowledge and belief the Applicant does business within the Commonwealth of Massachusetts and that the products and commodities identified below are known to be distributed and sold freely in the Commonwealth. The Department is unaware of any prohibition against the export of such products and commodities into El Salvador. As to the foregoing, the Department does so certify.

As a matter of policy, the Department strives to assist and promote Massachusetts agricultural businesses but does not endorse the products or commodities described. This statement is not to be construed as either an express or implied approval or warranty of any such product or commodity.

COMMODITIES: (List Below)

McIntosh Applies	402 cartons
Mutsu Apples	37 cartons

Date: 11-9-2012

Gregory C. Watson
Commissioner

COMMONWEALTH OF MASSACHUSETTS

Suffolk , ss November 9 , 2012

On this 9th day of November, 2012, before me, the undersigned notary public, personally appeared Gregory C. Watson, proved to me through satisfactory evidence of identification, namely, Personal Knowledge, to be the person who signed the preceding or attached document in my presence, and who swore or affirmed to me that the contents of the document are truthful and accurate to the best of his/her knowledge and belief.

Notary Public Michael C. Demakakos
My Commission Expires: 11-18-16

MICHAEL C. DEMAKAKOS
Notary Public
Commonwealth of Massachusetts
My Commission Expires
November 18, 2016

A1.4: Certificate of Free Sale

APPENDIX 2

COMMERCIAL INVOICE

Commercial Invoice

Date: *11-13-2012*

From:

WORLD FARMERS INC
769 Main St, PO Box 112
Lancaster, MA 01523
Maria Moreira
Phone: 413-658-4279 e-mail: mmoreira@worldfarmers.org

Ship To:

No de Registro: 219309-0
Attn:
Phone: email:

NIT: 0614-060112-102-4
INCOTERM: CIF

Full Description of Goods	No of Units	Unit Size	Weight (kg)	Unit Value (US$)	Value (US$)
Apples- McIntocsh-UMass#1	156	80,100,125	2830.46	$24.00	$3711.00
Apples- Mutsu #1	30	48, 56, 80	544.32	$26.00	$780.00
Apples - McIntosh-Carlson Orchard	135	120	2449.44	$33.00	$4,455.00
Apples - McIntosh-Carlson Orchard	61	88	1106.78	$37.00	$2,257.00

Country of Origin: USA **Total Weight:** 6931 **Total Value:** **$11,263.00**

No of Packages: *382* **FedEx Air Waybill No:**

I certify that the information on this declaration is true and correct to the best of my knowledge.

Name: *Maria c. Moreira* Signature:

A2.1: Commercial Invoice

APPENDIX 3

BILL OF LADING

Dole

DOLE OCEAN CARGO EXPRESS — **BILL OF LADING**

SHIPPER/EXPORTER (PRINCIPAL OR SELLER-LICENSE ADDRESS)
WORLD FARMERS INC
769 MAIN ST
(413)658-4279
LANCASTER MA 01523

DOCUMENT NUMBER
B/L NO. DOLQ ILG T5298SV

EXPORT REFERENCES
OTI LICENSE NO. 021212NF
WCF NO. 11/4479

CONSIGNEE (NOT NEGOTIABLE UNLESS CONSIGNED TO ORDER)

FORWARDING AGENT (NAME & ADDRESS-REFERENCES)
L.J. ROGERS, INC.
170 CHERRY & WEBB LANE
PO BOX 511
WESTPORT POINT MA 02791

NOTIFY PARTY/INTERMEDIATE CONSIGNEE (NAME & ADDRESS)
SAME AS CONSIGNEE

DOMESTIC ROUTING/EXPORT INSTRUCTIONS/ALSO NOTIFY
TLI0808-10-0002-0038
**ABRAHAM GARCIA
PH: 0053-22898483

SHIPPERS LOAD, WEIGHT AND COUNT, PARTICULARS FURNISHED BY SHIPPER WITHOUT CONTENTS OF TRAILER HAVING BEEN SEEN, INSPECTED OR VERIFIED BY CARRIER

PRE-CARRIAGE BY*
PLACE OF RECEIPT* BELCHERTOWN, MA

EXPORT CARRIER (VESSEL, VOYAGE) DOLE CHILE 224SI
PORT OF LOADING WILMINGTON, DE
RELAY PORT

PORT OF DISCHARGE PTO CASTILLA, HONDURAS
PLACE OF DELIVERY* SAN SALVADOR, ELS
TYPE OF MOVE DOR

PARTICULARS FURNISHED BY SHIPPER

MARKS & NUMBERS	NO. OF PKGS	DESCRIPTION OF PACKAGES AND GOODS	GROSS WEIGHT	MEASUREMENT
FREIGHT PREPAID AES ITN: X20121116013814	382	PKG APPLES MANZANAS FRESCAS INTO 1 X 40'ORF CNTR SWLAC: 382 PACKAGES TEMP SET @ 32° DEGREES FARH. VENTS: 25% OPEN SHIPPER WEIGHTS, LOAD STOW & COUNTS LADEN ON BOARD: DOLE CHILE 224SI WILMINGTON, DE. SAIL DATE : NOVEMBER 19, 2012 PER: THESE COMMODITIES, TECHNOLOGY OR SOFTWARE WERE EXPORTED FROM THE UNITED STATES IN ACCORDANCE WITH THE EXPORT ADMINISTRATION REGULATIONS. DIVERSION CONTRARY TO U.S. LAW PROHIBITED.	6931.000KGS 15280.240LBS	
CONTAINER NO. GESU9424581	SEAL NO. 47416	SIZE/TYPE PKGS WEIGHT 40 RF 382 6931.00 KGS		

Original

SHIPPER DECLARED VALUE $

NO. OF ORIGINAL B(s)/L
THREE

FREIGHT CHARGES		TO BE PREPAID	COLLECT
OCEAN FREIGHT	@ 3712.00	$ 3,712.00	
FUEL RECOVERY	@ 800.00	$ 800.00	
U.S. SECURITY	@ 156.00	$ 156.00	
C.A. SECURITY	@ 75.00	$ 75.00	
CAM I-MODAL SCHG	@ 260.00	$ 260.00	
LOW SULFUR SCHG	@ 30.00	$ 30.00	
PRE CARRIAGE	@ 900.00	$ 900.00	
TOTAL CHARGES	TOTAL	$ 5,933.00	

FREIGHT PAYABLE AT GLOBAL EL SAL. GLOBAL EL SAL.

RECEIVED FROM THE SHIPPER THE GOODS OR PACKAGES SAID TO CONTAIN GOODS HEREIN ABOVE MENTIONED IN APPARENT GOOD ORDER AND CONDITION, UNLESS OTHERWISE INDICATED, TO BE HELD AND TRANSPORTED AS HEREIN PROVIDED.

THE RECEIPT, CUSTODY, CARRIAGE, DELIVERY, AND TRANSSHIPPING OF THE GOODS ARE SUBJECT TO THE TERMS APPEARING ON THE FACE AND BACK HEREOF, AND CARRIER'S TARIFFS ON FILE WITH THE FEDERAL MARITIME COMMISSION, WASHINGTON, D.C.

IN WITNESS WHEREOF, THE MASTER OR AGENT OF THE SAID VESSEL HAS SIGNED 3 BILLS OF LADING, ALL OF THE SAME TENOR AND DATE, ONE OF WHICH BEING ACCOMPLISHED, THE OTHERS TO STAND VOID.

Liability limited to amount specified in Clause 17 unless increased value is declared by Shipper in writing to Dole Ocean Cargo Express Operations Manager at 9485 Regency Square Blvd. Suite 400, Jacksonville, FL 32225 and inserted in Box 23.

B/L NUMBER DOLQ ILGT5298SV PLACE DATE 11/19/12

FOR THE MASTER

*Applicable only when used in multimodal service

A3.1: Bill of Lading

APPENDIX 4

PHYTO-SANITARY PERMISSION FROM EL SALVADOR

MINISTERIO DE AGRICULTURA Y GANADERIA
DIRECCION GENERAL DE SANIDAD VEGETAL Y ANIMAL

COLECTURIA DE SAN MIGUEL
CARRETERA PANAMERICANA
KM. 142 SALIDA A LA UNION
TELS.: 2637-0160, 2637-0161

COLECTURIA MATAZANO
CANTON EL MATAZANO
SOYAPANGO TEL.: 2293-9853

COLECTURIA CUARENTENA
FINAL 1ª AVENIDA NTE. Y 13 C. OTE
Y AV. MANUEL GALLARDO, SANTA TECLA
TEL.: 2210-1780

COLECTURIA DE SANTA ANA
KM. 79 CARRETERA A CHALCHUAPA
CANTON EL PUENTEZUELO, M.A.G.
EX-IRA. TEL.: 2432 3337, 2402 0338

DIRO. SANIDAD AGROPECUARIA

COMPROBANTE DE CREDITO FISCAL
0000098920 108928
No. 11DS000U
NIT.: 0617 - 010331 - 001 - 2
NRC.: 65445 - 0

NIT: 0614-040113-103-4
CLIENTE:
DIRECCION:
MUNICIPIO:
DEPARTAMENTO:

FECHA DE EMISION: 27/11/2012
REGISTRO No.: 219309-0
GIRO:
CONDICION DE PAGO: CONTADO

EXPENDIO/VENTA DE OTROS PRODUCTOS NO CLASIFICADOS PREVIAMENTE

COLECTURIA DIVISION DE CERTIFICACION FITOZOOSANITARIA PARA EL COMERCIO

CANTIDAD	CODIGO	DESCRIPCION	PRECIO UNITARIO	VTAS. NO SUJETAS	VENTAS EXENTAS	VENTAS AFECTAS
1	1020	AUTORIZACIÓN FITOSANITARIA POR CADA EMBARQUE, PARA LA IMPORTACIÓN VÍA TERRESTRE Y AEREA, POR CADA 10,000 KILOGRAMOS O FRACCION NUMERO(S) DE AUTORIZACION(ES) I2012039929ST001 HASTA I2012039929ST001	8.000000			8.00
1	1040	INSPECCIÓN DE PRODUCTOS DE ORIGEN VEGETAL Y ANIMAL DE IMPORTACIÓN DE 5,001 HASTA 10,000 KG. AÉREOS, TERRESTRES Y MARÍTIMOS AUTORIZACION: I2012039929ST (1)	37.000000			37.00
1	1030	AUTORIZACIÓN FITOSANITARIA PREVIA DE IMPORTACIÓN DE PRODUCTOS Y SUBPRODUCTOS DE ORIGEN VEGETAL, ANIMAL E INSUMOS AGROPECUARIOS AUTORIZACION: I2012039929ST (1)	5.000000			5.00

CANCELADO

SON:
CANCELADO CINCUENTA Y SEIS DOLARES CON CINCUENTA CENTAVOS

SUMAS 50.00
13% - TOTAL 6.50
-1% RETENIDO 56.50
VTAS. NO SUJETAS .00
VENTAS EXENTAS
VENTA TOTAL

NOMBRE:
D.U.I.:
FIRMA RECIBE

NOMBRE:
D.U.I.:
FIRMA ENTREGA

DISTRIBUCION DE DOCUMENTOS

Cuando la factura sea mayor de $200.00 poner nombre y firma (Factura).
Cuando la compra sea mayor de $11,428.58 poner nombre y firma (Comp. de Crédito Fiscal).

ORIGINAL

FORMULARIO UNICO 56.50

A4.1: Phytosanitary Permission from El Salvador

APPENDIX 5

PICTURES DURING THE RESEARCH PROCESS

A5.1: McIntosh Apples at Umass Cold Spring Orchard, by Mildred Alvarado, 2012

A5.2: Grading and Packing Apples at Umass Cold Spring Orchard, November, 2012

A5.3: USDA Officer Inspecting Apples. Fresh Apples, November, 2012

A5.4: Fresh Apples after Inspected. Ready to be Exported, November, 2012

A5.5: Packed Apples from one of the Apples Source for this Research, November, 2012

A5.6: Packed Apples from one of the Apples Source for this Research, November, 2012

A5.7: Shipping Company Loading Apples to be Exported to Central America, November, 2012

A5.8: Fresh Apples from Massachusetts in the Containers in Central America, December, 2012

A5.9: Promoting Apples in Guatemala. At the Right, Manager of Fruits-Walmart Central America and Mexico, August, 2012

A5.10: Promoting Apples in San Pedro, Sula Honduras, FRUTVESA, August, 2012

A5.11: Container of the Shipping Company Waiting to be Inspected at El Salvador Custom, December, 2012

A5.12: Fresh Apples Waiting to be Released from the Customs in El Salvador, December, 2012

A5.13: Apples being Inspected by El Salvador Customs, December 2012

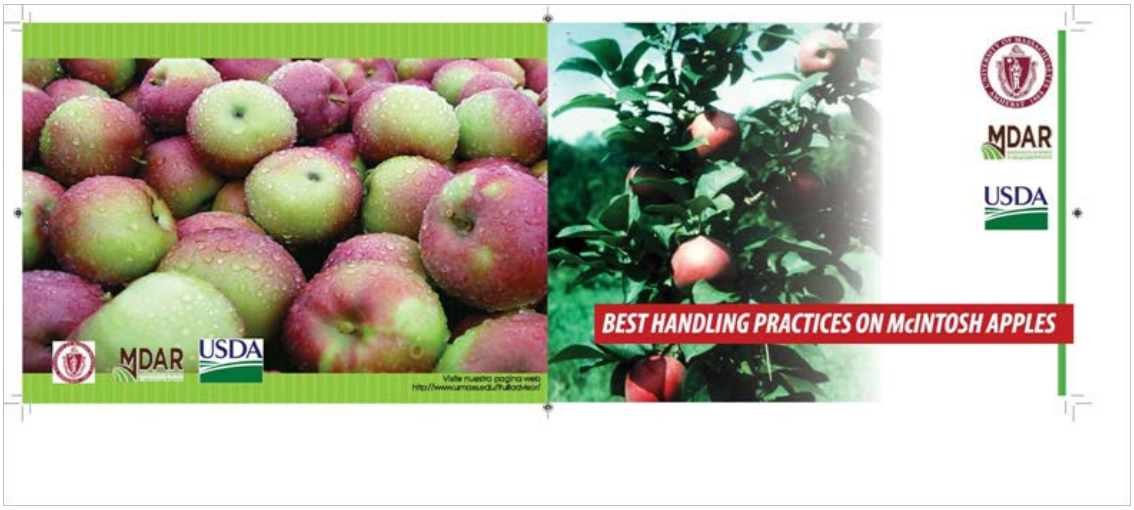
A5.14: Delivering Apples at the Distribution Center in El Salvador, December 2012

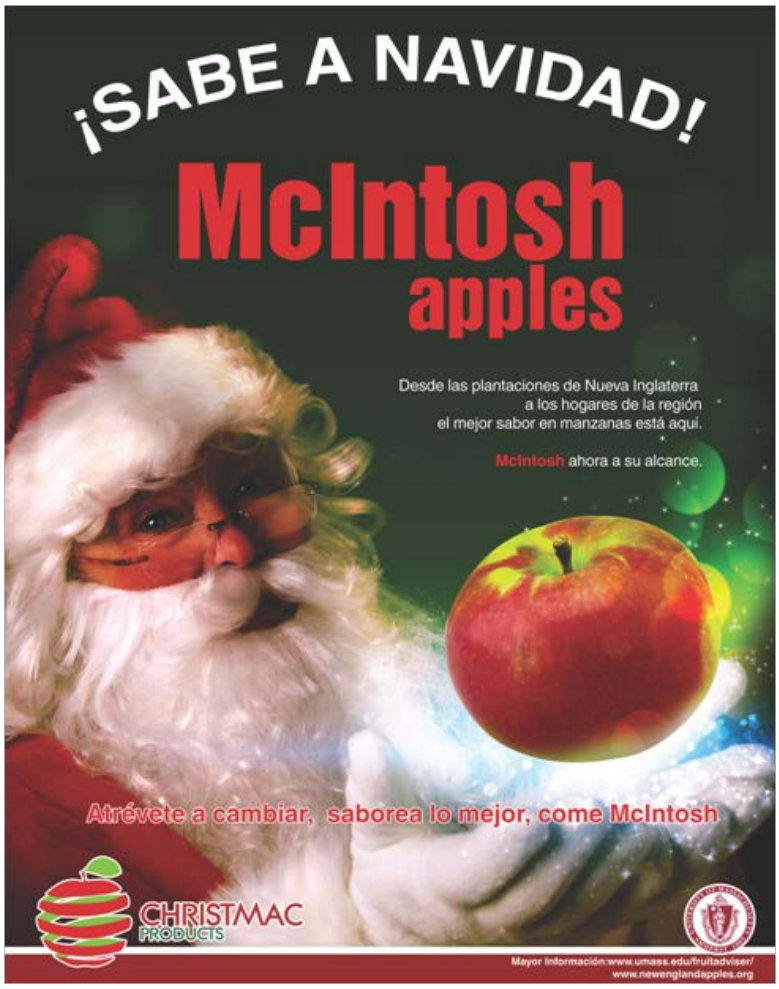
A5.15: McIntosh Apple Quality at the Distribution Center in El Salvador, December, 2012

A5.16: Enjoying McIntosh Apples in El Salvador

APPENDIX 6

MATERIAL OF PROMOTION CAMPAIGN FOR MCINTOSH APPLES




¡SABE A NAVIDAD!
McIntosh
apples
Desde las plantaciones de Nueva Inglaterra
a los hogares de la región
el mejor sabor en manzanas está aquí.
McIntosh ahora a su alcance.
Atrévete a cambiar, saborea lo mejor, come McIntosh
CHRISTMAC
PRODUCTS
Mayor Información:www.umass.edu/fruitadviser/
www.newenglandapples.org

REFERENCES

Agricultural Statistics Board, U.S. Department of Agriculture. Non-citrus Fruits and Nuts 2013 Summary. National Agricultural Statistics Service (NASS), 2013

Alan J. Patricof and Julie E. Sunderland, 2005. "In a Slew of Developing countries," Milken Institute Review 2 pp. 90-94

Alvarado, M. (2011). Analysis of the market for Massachusetts apples for markets in Central America. Amherst, Mass.: University of Massachusetts Amherst.

American Marketing Association. Retrieved from http://www.marketingpower.com

Atish R. Ghosh and Holger C. Wolk. (1994). pricing in international markets: Lessons from the economist. National Bureu of Economic Research. Cambridge, MA

Bramlage W.J. (1993). Interactions of orchard factors and mineral nutrition on quality of pome fruit. *Acta Horticulture* , 15-28.

Bramlage, W. J., Bareford, P. H., Blanpied, G. D., Dewey, D., Taylor, S., S.W, P., et al. (1977). Carbon dioxide treatments for 'McIntosh' apples before CA storage. *American Society for Horticultural Science* , 658-662.

Bureu, U. C., & Commerce, U. D. (2013).

Benjamin M. Oviatt and Patricia Phillips McDougall. 1994. Toward a Theory of International New Ventures. Journal of International Business Studies . Published by: Palgrave Macmillan Journals Stable URL: http://www.jstor.org/stable/154851

Brenes, E.R., et al., 2013. Differentiation strategies in emerging markets. The case of Latin American Agribusinesses, Journal of Business Research http://dx.doi.org

Brouthers, Keith D. 2013. A retrospective on: Institutional, cultural and transaction cost influences on entry mode choice and performance. Academy of International Business. UR - http://dx.doi.org/10.1057/jibs.2012.23

Banalieva, Elitsa R, Dhanaraj, Charles. 2013. Home-region orientation in international expansion strategies. Academy of International Business. http://dx.doi.org/10.1057/jibs.2012.33

Casillas José, Moreno-Menéndez Ana. 2013. Speed of the internationalization. Journal of International Business Studies. Palgrave Macmillan. http://www.palgrave-journals.com

Carlson, Frank. Personal communication. Massachusetts Apple Grower. Massachusetts, 2012.

Central Intelligence Agency. 2010 Gross domestics products (GPD) in Central America on purchasing power parity Basis (PPP). Available at: https://www.cia.gov, 2010.

Clyde E. Witt, 2005. “International Hires Global Trade Management Specialists”, Material Handling Management. http://www.wavelink.com/news/nr_files/nr_05_MHM_RFID.pdf

Color requirements.| LII / Legal Information. (n.d.). Retrieved from http://www.law.cornell.edu/cfr/text/7/51.305).

Church, I.J. & Parsons, A.L.: (1995) Modified Atmosphere Packaging Technology: A Review, Journal Science Food Agriculture, 67, 143-152

DeLong, J. M., Harrison, P. A., & Prange, R. K. (2004). The influence of 1-methylcyclopropene on 'cortland' and 'McIntosh' apple quality following long term storage. *HortScience : A Publication of the American Society for Horticultural Science*, *39*(5), 1062-1065.

Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics, U.S. State Export Data. "Fresh Apples Exports, 2008-2010." 2012.

Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics, U.S. State Export Data. "US apple exports to El Salvador, 2005-2012." 2012.

Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics, U.S. State Export Data. "US apple exports to Honduras, 2005-2012." 2012.

Day, B.P.F.: (1996) A perspective of modified atmosphere packaging of fresh produce In Western Europe, Food Science and Technology Today, 4,215-221

Eric, Sletten. (1194). How to succeed in exporting and doing business internationally. John Wiley & Sons, Inc. USA

Exporting and Logistics: SPECIAL ISSUES FOR BUSINESS. Retrieved from: http://en.convdocs.org/docs/index-28699.html?page=5

Eugene, K. (1994). Maturity and Storage of Gala, Fuji, and Braeburn Apples. Washington State University - Tree Fruit Research & Extension Center “Postharvest Information Network - Retrieved from http://postharvest.tfrec.wsu.edu/pages/J5I3A

FAO, Food and Agriculture Organization. To apple producing countries. Available at www.fao.org, 2010.

Food Export-Midwest and Food Export-Northeast. Central American Profile. Available at: http://www.foodexport.org/, 2012.

Ferguson, I., & Watkins, C. (1989). Bitter pit in apple fruit. Hort. Rev. 11:289-355.

Federal Register | Apples; Grade Standards. (n.d.). Retrieved from https://www.federalregister.gov/articles/2002/11/19/02-29034/apples-grade-standards)

FreshFruitPortal.com » Apples lead fruit imports in Central. Retrieved from http://www.freshfruitportal.com/2012/10/30/apples-lead-fruit-imports-in-central-america-but-not-consumption/).

Greene, D. W. (2001). CPPU influences fruit quality and fruit abscission of 'McIntosh' apples. *HortScience : A Publication of the American Society for Horticultural Science, 36*(7), 1292-1295.

Greene, D. (2010). *PLSOILIN 300-Decidiuos Orchard Sciences.* Amherst: Class Notes - University of Massachusetts.

Gregory, A, 2005 “Avoiding Supply Chain Strangulation;” Works Management, Spring 2005. Leeds Metropolitan University

Han, S. (2013). *PLNTSOIL545 Postharvest Biology* . Amherst: Lecture, UMass Amherst.

Harker, F., Redgwell, R., Hallet, I., & Murray, S. (1997). Texture of fresh fruit. *Horticultural reviews* , 121-224.

Hatfield, S., & Knee, M. (1988). Effects of water loss on apples in storage. *International Journal of Food Science and Tecnhology* , 575-583.

Ingretation Central American Economic, 2013. www.sieca.org.

Isobel, D., & Lowe, R. (2008). International marketing strategy: Anylisis, Development, and

Implementation. Cengage Learning EMEa

Ingle, M., D'Souza, M., & Townsend, E. (2000). Fruit characteristics of 'York' apples during development and after storage. *HortScience* , 95-98.

International Monetary Fund.www.imf.org

Jung, S. -. K. (2009). Effects of 1-methylcyclopropene (1-MCP) on ripening of apple fruit without cold storage. *The Journal of Horticultural Science & Biotechnology, 84*(1), 102-106.

Johnson, D. (1994). Influence of time of flowers and fruit thinning on the firmness of 'Cox's' Orange Pippin' apples at harvest and after storage. *Horticultural Sciece* , 197-203.

Johnston, J. W., Errol W, H., & Hertog, M. L. (2002). Postharvest softening of apples (Malus domestica) fruit: A review. *New Zealand Journal of Crop and Horticultural* , 145-160.

Katzner, D. W. (1970). Supply and demand; Mathematical models. New York: Mcacmillan.

Kotler, P. (1986). Principles of Marketing (3rd ed). New Jersey: Prentice Hall.

Kotler, P. (1996). Principles of Marketing (6rd ed). New Jersey: Prentice Hall.

Kader, A. A. (2002). Postharvest tecnology of Horticultural crops. *3rd. ed. University of California Press* .

Kader, A. A., Morris, L. L., & Cantwell, M. I. (2001). *Postharvest Handling and Physiology of Horticultural crops: A list os selected references.* California: University of California; Davis CA.

Kays, S. J., & Paull, R. E. (2004). *Postharvest Biology.* Georgia: Exon Press.

Lancaster, K. (1971). Consumer demand: a new approach. New York: New York.

Lidster, P. G. (1990). *Controlled-atmosphere disorders of commercial fruits and vegetables.* Ottawa: Agriculture Canada: Publication 1847E.

Lisa Kitinoja and Adel A. Kader, 2002. Postharvest Horticulture Series No. 8E. Small-Scale Postharvest Handling Practices: A Manual for Horticultural Crops (4th Edition). University of California, Davis. Postharvest Technology Research and Information Center. Available at: http://www.fao.org/docrep/009/ae075e/ae075e20.htm

Lu, X., Liu, X., Watkins, C. B., Nock, J. F., & Ma, Y. (2013). *Effects of repeated 1-methylcyclopropene (1-MCP) treatments on ripening and superficial scald of 'Cortland' and 'Delicious' apples [electronic resource]* Elsevier B.V.

Mann, H., Vickers, Z., Tong, C., Bedford, D., & Luby, J. (2005). Relationship of instrumental and sensory texture measurements of fresh and stored apples to cell number and size. *HortScience : A Publication of the American Society for Horticultural Science, 40*(6), 1815-1820.

Marmo, C. A. (1983). Effects of maturity, fruit size, and microelement concentrations on predicting the storage life of McIntosh apples

Marlow, G., & Loescher., W. (1984). *Watercore. Hort. Rev. 6:189-251.*

McArtney, S. J., Parker, M. L., Edgington, T. B., Obermiller, J. D., & Schupp, J. R. (2008). Preharvest 1-methylcyclopropene delays fruit maturity and reduces softening and superficial scald of apples during long-term storage. *HortScience : A Publication of the American Society for Horticultural Science, 43*(2), 366-371.

McCalley, R. W. (1996). Marketing Channel Management. Westport: Praeger Publishers.

McCarthy, E. J. (1964). Essentials of Marketing. Illionis: Richard D. Irwin, INC.

Meheriuk, M. (Michael), 1936-; Canada. Agriculture and Agri-Food Canada "Postharvest disorders of apples and pears (1994) Full text of "Postharvest disorders of apples and

pears" Retrieved from http://archive.org/stream/postharvestdisor00mehe/postharvestdisor00meh)Web.

Moran, R. E. (2006). Maintaining fruit firmness of 'McIntosh' and 'cortland' apples with aminoethoxyvinylglycine and 1-methylcyclopropene during storage. *Horttechnology, 16*(3), 513-516.

Muth, J. F. (1961). Rational Expectations and the Theory of Price Movements. The Econometric Society.

NASS/USDA, National Agricultural Statistics Service. Available at www.nass.usda.gov, 2012.

National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S Department of Agriculture. Commercial apples: bearing acreage. Non-Citrus Fruits and Nuts 2012 Summary.

National Trade Estimate Report on Foreign Trade Barriers, 2004. www.ustr.gov,

Nock, J. F., & Watkins, C. B. (2013). Repeated treatment of apple fruit with 1-methylcyclopropene (1-MCP) prior to controlled atmosphere storage [electronic resource]. *Postharvest Biology and Technology, 79*, 73-79.

Parsley, David C., 2004. Pricing in International Markets: a "Small-country" Benchmark Review of International Economics. Blackwell Publishing Ltd. Available at: http://dx.doi.org/10.1111/j.1467-9396.2004.00464.x

Pervez Ghauri and Philip Cateora. (2009). Marketing International. Edinburg Bussines School.

Philip R. Cateora and Jonh L. Graham, 2007. International Marketing (13th edition). McGraw-Hill Irwin. New York.

Pooviaih, B. W., Glenn, G., & Reddy, A. (1988). Calcium and fruit softening: physiology and biochemistry. *Horticultural Reviews* , 107-152.

Robert P. King, Michael Boehlje, Michael L. Cook, and Steven T. Sonka. 2010. Agribusiness Economics and ManagementAm. J. Agr. Econ.

Respiration (n.d.). In Merriam Webster Dictionary. Retrieved from http://www.merriam-webster.com/dictionary/respiration)

Rupasinghe, H. P. V., Skog, L., Paliyath, G., & Murr, D. P. (2000). Inhibitory effect of 1-MCP on ripening and superficial scald development in 'McIntosh' and 'delicious' apples. *Journal of Horticultural Science & Biotechnology, 75*(3), 271-276.

Scherkebanch, W. (1992). *The deming Route to Quality and Productivity.* Washington DC: George Washington University: CEEPress Books.

Serek, M., Tamari, G., Sisler, E. C., & Borochov, A. (1995). Inhibition of ethylene-induced cellular senescence symptoms by 1-methylcyclopropene, a new inhibitor of ethylene action. *Physiologia Plantarum, 94*(2), 229-232.

Smith, W. (1963). The use of Carbon Dioxide in the transport and storage of fruits and vegetables. *Adv. Foog Res* , 95-146.

Salomon, Robert M. Shaver, J. Myles. 2005. Learning by Exporting: New Insights from Examining Firm Innovation. Journal of Economics & Management Strategy. Blackwell Publishing, Inc. http://dx.doi.org/10.1111/j.1530-9134.2005.00047.x PY - 2005

Seperich, G. J., W, W. M., & Beierlein, J. G. (1994). Introduction to Agribusiness Marketing. NJ: Prentice Hall Career & Technology.

Sletten, E. (1994). How to succeed in exporting and doing business internationally. John Wiley & Sons, Inc.

Steban R. Brenes, Daniel Montoya, Luciano Ciravegna, 2013. Differentiation strategies in emerging markets: The case of Latin American agribusinesses, Journal of Business Research, Available online 31 July 2013, ISSN 0148-2963, http://dx.doi.org/10.1016/j.jbusres.2013.07.003.

Terrance H. Witkowski, "Antiglobal Challenges to Marketing in Developing countries: Exploring Ideological Divide," Journal of Public Policy and Marketing 24, no. 1 (2005), pp. 7-23

The World Bank.www.worldbank.org

Temperature and Humidity Control. Retrieved from: ww.postharvest.ucdavis.edu/files/93612.pd

Terms of sale (Incoterms). Retrieved from: http://www.spadarointernational.com/terms-sale.aspx

Tolerances. Legal Information Institute. (n.d.). Retrieved from http://www.law.cornell.edu/cfr/text/7/51.306).

NYS DEPARTMENT OF AGRICULTURE AND MARKETS. (n.d.). Retrieved from http://www.agriculture.ny.gov/FS/pdfs/farmcircs/circ859.pdf)

U.S. Department of Agriculture (2002). United States Standars for Grades of Apples.

U.S. Department of Agriculture - Agriculture Research Service, 2004. Agriculture Handbook Number 66 "The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks" available at: http://www.ba.ars.usda.gov/hb66/027apple.pdf

U.S. Department of Agriculture, (2013). Fresh Deciduous Fruit (Apples, Grapes, and Pears): World Markets and Trade. Foreign Agricultural Service.

USDA, U. S., & AMS, A. M. (2005). United Stated Standards for grades Apples.

USDA ERS - Food Dollar Series: Documentation. (n.d.). Retrieved from http://www.ers.usda.gov/data-products/food-dollar-series/documentation.aspx)

U.S. Department of Labor / Bureau of Labor Statistics/ Washington, D.C. 20212 - Consumer Price Index All Urban Consumers - (CPI-U) U.S. city average All items 1982-84=100. Available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt

USDA01.library.cornell.edu. (n.d.). Retrieved from http://usda01.library.cornell.edu/usda/current/NoncFruiNu/NoncFruiNu-01-25-2013.txt

United States Trade Representative.www.ustr.gov

Von Mollendorff, L. J., De Villiers, O. T., & Jacobs, G. (1992). The effects of storage temperature and fruit size on firmness, extractable juice, woolliness and browning in two nectarine cultivars. *Journal of Horticultural Science, 67*(5), 647-654.

Warner, H. K. (2003). Apples and beyond: Future goals of 1-MCP. *Acta Hort* .

Watada, A.E; Herber, R.C; Kader, A.A; Romani, R.J.; Staby, G.L. (1984). Terminology for the description of the developmental stages of horticultural crops. *HortScience* , 20-21.

Watkins, C. B. (2006). The use of 1-methylcyclopropene (1-MCP) on fruits and vegetables. *Biotechnology Advances* , Volume 24, Issue 4, July–August 2006, Pages 389-409, ISSN 0734-9750. Retrieved from (http://www.sciencedirect.com/science/article/pii/S073497500600022X)

Watkins, C. B., & Miller., W. B. (2004). A summary of physiological processes or disorders in fruits, vegetables and ornamental products that are delayed or decreased, or affected by application of 1-methylcyclopropane (1-MCP). htt://www.hort.cornell.edu/mcp/.

Watkins, C. B., Whitaker, B. D., & Nock, J. F. (2000). *Responses of early, mid and late season apple cultivars to postharvest application of 1-methylcyclopropene (1-MCP) under air and controlled atmosphere storage conditions [electronic resource]*

Watkins, C. B., & Nock, J. F. (2012). *Rapid 1-methylcyclopropene (1-MCP) treatment and delayed controlled atmosphere storage of apples [electronic resource]* Elsevier B.V.

Weis, S. A. (1983). Relationships Linking Preharvest Mineral Nutrition of 'McIntosh' Apple Leaf and fruit to Storage Disorders of Fruit. Amherst MA: University of Massachusetts.

Wesley R. Autio and William J. Bramlage (n.d.). Foliar Calcium Sprays for Apples. UMass Amherst Fruit Advisor. Available at: http://extension.umass.edu/fruitadvisor/fact-sheets/foliar-calcium-sprays-apples

Wills, R. H., Lee, T. H., Graham, D., McGlasson, W. B., & Hall, E. G. (1981). *POSTHARVEST* - An introduction to the Physiology and Handling of Fruit and Vegetables. Westport: AVI.

World Apple Report: Record China Production; (n.d.). Retrieved from http://wherefoodcomesfrom.com/article/7841/World-Apple-Report-Record-China-Production-EU-Remains-Largest-Exporter)