VEGETABLE PRODUCTION CONCENTRATION IN NORTHWEST MEXICO

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ABSTRACT

Vegetable Production Concentration in Northwest Mexico

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An American company that supplies premium quality hybrid vegetable seed to commercial growers in the southern part of the US, Mexico, and Central America sought an assessment of the market potential in the Northwest region of Mexico by identifying land area and production concentrations of vegetables by location, crop, and cultivation method, whether open-field, greenhouse, or shade house.

Data on the cultivated area of four states in the Northwest region of Mexico was collected for 12 crops of interest for the period of 2003-2012 from secondary sources. Data was entered into a statistical software program to complete frequency distribution charts of each state by crop and cultivation method to determine crop concentrations. Trend data of cultivated area was also analyzed to see changes in cultivation methods over a 10 year period and estimates were made by for NW Mexico through 2017.

An analysis of vegetable production in Northwest region of Mexico showed open-field cultivated area was heavily location specific with near monocultures present, especially in the state of Sinaloa. Two-thirds of the crops had a substantial portion of their cultivated area (35-80%) occurring in one place, with bell pepper, onion (green), spinach, and cucumber having a dominant percentage (80-100%) of their cultivation occurring only in Sinaloa. Although it made up a small percentage of overall cultivated area, the majority of protected culture cultivation was also located in Sinaloa, and was shown to have grown rapidly since being introduced or first appearing in government data sources in 2003. With open-field cultivation giving way to more technologically advanced cultivated methods of protected culture, and with the majority of protected culture and open-field export farming taking place in Sinaloa, further input suppliers' marketing efforts should be concentrated there.

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Chapter 1

INTRODUCTION

Mexican Vegetable Production Sector

For Mexico, both agricultural exports and imports have increased significantly in recent years (see Figure 1) and are highly concentrated towards the United States (US), with the US accounting for the majority of Mexico's agricultural trade. The composition of trade has changed over time between the US and Mexico as more staple crops and meats are exported to Mexico from the US and more beverages, seasonal fruits, and vegetables are being imported from Mexico to the US (United Nations, 2013). Mexico's climate variation from tropical to temperate allows growers to produce a wide spectrum of fruits and almost any vegetable in a variety of cultivation methods including open-field (OF), greenhouse (GH), and shade house (SH) (Flores and Ford, 2010). The highest valued fresh vegetable exports from Mexico are tomatoes, peppers, onions, and cucumbers followed by a wide variety of products that include asparagus, potatoes, lettuce, carrots, and celery (United Nations, 2011).

Rising incomes, improved technology and infrastructure, falling transportation costs, and evolving international agreements have led to this substantial growth in the volume and variety of vegetables traded between the US and Mexico since the early 1990's (Gayou and Orozco, 2003). Specifically, the passage of the North American Free Trade Act of 1994 (NAFTA) has been a prime factor in the increased export of fresh fruits and vegetables to the US. NAFTA removed trade tariffs and enabled easier cross-border trading of agricultural products between

the United States and Mexico, making trading across borders cheaper, quicker, and more profitable (FAS-USDA, 2002). Mexico's agricultural exports to the US have expanded by nearly 9% per year, growing twice as fast as they did before NAFTA (See Figure 1).

Figure 1. Mexican Agricultural Imports and Exports:1990-2010 in US \$ billion.
Source: United Nations, 2011.

US imports of fresh fruits and vegetables from Mexico nearly doubled from \$1.2 billion in 1994 to \$2.3 billion in 2001, with the main export crops being tomatoes, onions, peppers, melons, avocados, mangoes, grapes, cucumbers and asparagus (FAS-USDA, 2002). Leading vegetables consumed domestically in Mexico are potatoes, tomatoes, and chili peppers (Stout, *et al.*, 2002). The regions of North West (NW) Mexico dominate fruit and vegetable production because economies of scale can be realized in this region. Larger commercialized farms are more often found in the NW region of Mexico where export markets are closely located, whereas central and southern areas of Mexico are more likely to have farms smaller in size (5 Ha or less) and serve local markets (United Nations, 2011). Larger producers are also more

likely to receive loans through Mexico's commercial and development banks because they are more likely to meet lending standards than small farmers with little capital (United Nations, 2011). Premium-priced produce and access to capital investment loans allow for more resource-intensive farming procedures such as protected culture (PC). Correspondingly, the majority of PC production is located in the NW region. An environment of large markets, investment capital, and the potential for premium prices makes NW Mexico a desirable supply area for quality vegetable seed.

The Mexican Seed Industry

The vegetable seed market has seen consistent growth since the 1980's, mostly derived from increased international trade in fruits and vegetables (Huang, 2004). Mexico primarily uses domestic seeds, but imported seeds continue to play a major role in the sector. Consequently, domestic seeds continue to be the main competitor against US seeds in Mexico; however, the US seed export market to Mexico has consistently increased since 1999, spurred initially by lower domestic quality and higher cost of Mexican seed (Hernandez, 2008). Between 2003 and 2007, improvements were made in the quality of Mexican seed, but the quantity remained insufficient to cover current domestic demand, leading to increased imports from US markets and decreased exports (Hernandez, 2008). According to the Seed Inspection and Certification National Service of Mexico (SNICS), in 2007, the total value of imported planting seeds reached a high of \$672.9 million. The US supplied approximately 27% of all seed imports to Mexico with a total value of \$179.5 million (Hernandez, 2008). Mexico also has imported a considerable amount of seeds from Canada, and multinational companies have been able to source seeds from different parts of the world. Additionally, Mexican seed laws enacted in 2007 seemed to favor international seed companies with a direct foreign investment presence in-

country by removing import barriers for imported seed and strengthening intellectual property rights for domestic production of hybrid vegetable seed (Hernandez, 2008).

Increasing utilization of PC in the form of GH and SH cultivation has affected seed markets as well. PC cultivation in Mexico grew exponentially from 750 hectares (1 hectare [Ha] = 2.471 acres) in 1999 to approximately 20,000 Ha in 2009 (Flores and Ford, 2010). That growth in PC has spurred seed sales with higher quality seed input (genetics) requirements. Seed requirements in PC can be up to five times higher than OF production with intensive plant populations per Ha and longer growing seasons (in some locations year-round harvests are possible), making multiple planting seasons possible from crops normally grown annually in OF cultivation settings (Abraham and Pacheco, 2006). Longer harvest periods combined with decreased production risks, associated with modified/controlled environments, limit damage (insect, disease, or weather) and result in yields six to eight times higher than that of OF cultivation (AIS, 2008; Perea and Suarez, 2012).

PC represents a small portion of total cultivated area in Mexico, with OF comprising 98%. High start-up costs and limited technological knowledge have prevented Mexican farmers with utilizing more PC in their farming cultivation methods (Flores and Ford, 2010). Additionally, some plants are not suited for PC because of the space requirements needed for cultivation. Currently vine and small seed-based crops grow best, while plants such as fruit trees that have extensive root systems and height requirements are not suited to the PC approach. Cultivation levels of PC are expected to continue to rise for the next several years, especially for tomatoes, bell peppers, and cucumbers, most of which are produced in the northern Mexican states for US export markets (Perea and Suarez, 2012).

Individual farmers, large multinational companies, private domestic seed companies, seed distributors, national and state public research branches, and seed production organizations made up the Mexican seed industry as of 2008. The private sector held 94% of the seed market share, while the public sector accounted for the remaining 6% (Hernandez,

2008). As of 2002, Mexican seed distribution channels were not well developed. Market competition consisted of several large dominant firms and a competitive fringe of smaller firms.

Seed distributors usually sold hybrid seed to dealers (including large supermarkets and home improvement stores) who then sold to farmers (Gayou and Orozco, 2003). Larger companies provided their own links to foreign markets, technology, and capital and had strong logistic capabilities for seed production, but high overhead costs. Smaller firms such as local, regional, and national vendors, seed breeding companies, and farmers groups were found more effective in seed sales because they had a better knowledge of local conditions and lower overhead costs (Van der Meer, 2002). Since the early 2000's, several larger companies have managed to secure local branch offices and conduct seed distribution on a regional basis, giving them the benefit of direct sales and education opportunities to provide training and technical assistance for clients, while still maintaining the benefits of a large corporation (Flores, Dulce and Ford, 2010).

Ahern International Seeds, Inc.

Ahern International Seeds, Inc. (AIS) is an American company, which supplies premium quality hybrid vegetable seed to commercial growers in the southern part of the US, Mexico, and Central America. In 2013, the company sold 600 varieties of seeds across 34 vegetable species, the most important of these species being tomatoes and peppers (hot and bell pepper). AIS has their strongest foothold in the vegetable seed market of Mexico, with an estimated 25% of market share as of 2007 (AIS, 2008). The head office is located in San Diego, CA, with satellite offices in Texas, Florida, and key Mexican cities. In Mexico, seven satellite offices and warehouse facilities are located in the Northern and Central regions, specifically in Ensenada, Culiacan, Guadalajara, Nogales, Torreon, Celaya, and Puebla. AIS works in coordination with

leading vegetable seed breeder-producers including DeRuitter, Syngenta, Enza Zaden, Vilmorin, Hazera, and Zeraim Gedera, buying seed on a national level and reselling it through regional field offices. In 2007, the company served over 1,000 Mexican produce entities ranging in size from farms of less than 4 Ha to corporate operations as large as 2300 Ha (AIS, 2008).

With offices located throughout Mexico, AIS is positioned to expand local field operations and is researching recent cultivation trends in the Mexican fresh produce and vegetable industry. AIS has a specific interest in penetrating PC markets, while also strengthening their position in sales of OF cultivation of brassica seed. By researching cultivation trends of particular brassica crops of interest, AIS can identify the total cultivated Ha of particular crops within an individual state and allows AIS to determine potentially underserved markets which can be better penetrated by AIS sales offices. By providing superior seed along with field knowledge and education to those able to employ cultivation methods using higher capital, AIS can open their business to new markets which are more likely to switch to using quality hybrid seed. AIS has identified the Northwestern (NW) region of Mexico as a potential area for business expansion, as it holds 21% of brassica vegetable cultivated area of Mexico (SAGARPA, 2011¹), and the highest percentage of exported produce and use of PC, both of which demands a higher prices than OF cultivated, domestic produce markets. Particular states of focus are the NW states of Baja California Norte, Baja California Sur, Sinaloa, and Sonora.

Statement of the Problem

What is the aggregate market size of annual vegetable seed use in NW Mexico and how is it distributed geographically?

¹ SAGARPA is the Mexican Department of Rural Fisheries and Food Development. Their purpose is to provide farmers in the agrifood chains reliable and timely information for making decisions which contribute to sustainable rural development.

Hypothesis

Sinaloa will be the major substantial producer measured in cultivated area owing to their developed PC infrastructure and proximity to the US allows for a consistent and high value export market.

Objectives of the Study

1. To identify trends in vegetable crop cultivated area and value in NW Mexico.
2. To determine the highest vegetable production areas by state and cultivation method in NW.
3. To determine opportunities for sub-markets of NW.

Significance of the Study

As of 2009, the agriculture sector made up only 4% of the national GDP, but employed 13% of the population, representing over 8 million workers overall (OECD, 2011). Mexico grows fruits and vegetables on about 4% of its agricultural land, representing an \$8 billion industry, with about 20% of Mexico's fruit and vegetable production cultivated for export markets located predominantly in the Northern regions (Hernandez, 2008; Stout, *et al.*, 2002). The NW made up 21% of all brassica vegetable cultivated area in Mexico totaling over 76,000 Ha, with Sinaloa representing the biggest portion owning 11% of all cultivated area of brassica vegetables (SAGARPA, 2011). PC area shares are reported to be concentrated in Sinaloa (28%), Baja California Norte (14%), Baja California Sur (11%), and Sonora (11%) with a total of approximately 17,000 Ha currently in operation as of 2008, mostly devoted to tomatoes, peppers and cucumbers (Flores and Ford, 2010).

With Mexico's proximity to the US, optimal winter growing conditions, and relatively less expensive agricultural land and labor inputs, it is no surprise Mexico is the top exporter nation of fresh fruits and vegetables to the US. A large export market for fruits and vegetables could indicate a large import market for fruit and vegetable seed (Fernandez-Cornejo, 2004). Key export crops to the US are tomatoes, sweet peppers, cucumbers, and melons. Exported GH and SH tomatoes to the US in 2012 were up 18% over 2011 and up 37% over the average three-year period. Exports of PC bell peppers were up 8% in the first four months of 2012 over the previous year and up 28% over the average from the three previous years indicating a positive trend for PC exports (Manjarrez, 2013). Growers expect 2012-2013 to be a good year for PC compared to previous years.

Placement of local field offices in critical areas of vegetable cultivation, along with an emphasis on value-added services to growers, have been key drivers for AIS' success and has proven to be a way for AIS to differentiate itself from competitors. AIS has well versed horticultural engineers serving the Mexican vegetable farming sector and maintains a professional development program with Centro de Investigacion en Alimentacion y Desarrollo (CIAD, Sinaloa), a government sponsored research institute located in Sinaloa, which facilitates training in GH and SH cultivation (AIS, 2008). The firm's services include development and selection of new premium genetics for Mexican markets, field training, crop consultations, pathology and nutrition analysis, and warehousing storage and delivery to facilitate international trade. In 2013, AIS developed their own research facility for trial plots in Baja, MX to further enable the ability to improve partnerships with clients by providing cutting edge technologies, planting demonstrations, and services to farmers.

Offering outreach services can be essential to farmers, especially those entering PC markets and facing higher risk of failure due to high capital costs combined and lack of technical knowledge on PC cultivation operations (Flores and Ford, 2010). With continued growth and new shifts occurring within regions and production practices, AIS requires accurate and

applicable data to make effective and critical business decisions. AIS method for determining market size in a region is conducted by sales employees attempting to count the amount of cultivated Ha of individual crops through visual analysis of a region. This method has provided AIS sales people a first-hand account of where potential markets may be but this data should be backed up with other accurate and historical data sources to identify trends and accuracy of employee predictions. Analyzing the Mexican government database of reported cultivated Ha provides an opportunity to check if observed produce trends mirror the government data collected.

Chapter 2

REVIEW OF THE LITERATURE

The Mexican Vegetable Industry

The Mexican vegetable industry has evolved from a highly regulated industry to one that is market driven, making it easier, in theory, for private companies to operate. Mexico's agricultural sector is still adapting to these structural market changes and continues to experience adjustment problems as the government seeks to move policy away from import substitution and self-sufficiency to a market oriented, competitively structured industry (United Nations, 2013). This development, combined with a strengthening of legal protection of intellectual property rights in the second half of the 20th century promoted both private domestic investment and foreign direct investment from large corporations, which has contributed to the occurrence of seed industry concentration characterized by widespread mergers and acquisitions in the latter part of the 20th century.

Those mergers have created large enterprises that have expanded the use of newer technology in agriculture including improved irrigation methods, incorporation of PC, and advancement of plant breeding and certified hybrid seed creation. Private research and development (R&D) expenditures on plant breeding increased 1300% between 1960 and 1996 (adjusted for inflation), while public (government institutions including government funded universities) R&D expenditures changed little (Fernandez-Consejo, 2004).

Technological improvements in agriculture have improved both production rates and quality of produce, including higher yields, increased product homogeneity, and more predictable harvests, which reduces the risks to output volatility (United Nations, 2013). These attributes not only increase the competitiveness of the commodity sector and open market niches, but they also make forward contracts possible between Mexican producers and buyers, giving producers access to capital and agricultural credit for new investments. However, in order to achieve higher yields and sustainable incomes for producers, programs passing technological knowledge and resources to farmers must be put in place to deliver these services (OECD, 2011). To reinforce the sustainability of small and medium-scale producers and to increase their competitiveness, the introduction of improved farm management practices, including the use of high quality seeds, fertilizer and PC technology are necessary (OECD, 2011).

Mexico does not have an agricultural extension service. Research institutes, research centers, and universities do not have programs in place to transfer technology and field knowledge from the institutional level to rank and file farmer regions, making dissemination of best practice information subject to longer lag times and results in a loss of efficiency from spill-over benefits from improved technology (OECD, 2011). Rather, farmers can receive technical assistance through various support programs funded through SAGARPA, the Mexican Department of Rural Fisheries and Food Development similar to the US Department of Agriculture. Under SAGARPA, technical assistance is delivered through professional service providers (PSP), whose function is to implement development programs at the farm level. Technical services include strategic planning, project development, technical advice, business strategy, and training to support farmers to increase their efficiency and facilitate their integration into value chains. Criticisms of the program include that PSP's are not agricultural professionals, they hold limited knowledge, they are not connected to new information and

technology, there are no performance measures or accountability to achieve indicated goals of technical assistance, and the program is underfunded (OECD, 2011).

Seed Use

Technology is playing an increasing role in ensuring vegetable growers have more control over a crop's yield, cost, and resistance to disease, while also improving the consistency and reliability of appearance, quality and supply (Syngenta Annual Report, 2010). Increasing demand for food, in tandem with the growing global population, has pushed technological advancements in seed yields and quality. R&D on the application of science to seed selection for plant improvement has produced significant changes in the agricultural industry and cultivation of row crops. The produce industry has changed dramatically over the previous century as more farmers switch to purchasing hybrid and certified seed in lieu of saving seed from the previous harvest (Hernandez, 2008; Nawn and Trejo, 2007).

A hybrid seed or "improved" seed is the product of a cross among two or more families of the same plant. The advantage of hybrids over traditional saved seed is the active selection of genetics, such as the ability to bear extreme climates, to resist insects, diseases, or drought, ultimately leading to higher yields and smaller losses due to external factors. For example, saved hybrid corn seed would produce substantially lower yields than purchased hybrid seed, which encourages repurchase by farmers. Annual fruits and vegetables, including broccoli, cabbage, cauliflower, celery, cucumber, lettuce, leeks, melons (cantaloupe, honeydew, and watermelon), onions, papaya, peppers (hot and sweet), pumpkin, squash, spinach, tomatoes, and leafy greens are increasingly being grown from hybrid seed (Tay, 2007).

Biotechnology is expected to drive the Mexican seed market in the future (Otero and Hansen, 2012). Despite current biotechnology laws and regulations aimed at preventing and

controlling the possible use and application of biotechnology products, Mexico has a strong biotech infrastructure including world renowned biotech research institutions, a government commission dedicated to coordinating biotech policy, and an active private sector that promotes the positive use of biotech seeds. The government of Mexico has continued moving forward on biotechnology despite the strong opposition and the media campaign of several anti-biotech organizations (Otero and Juarez, 2012). In 2012, the Mexican government approved genetically modified (GM) soybean cultivation for the regions of the Yucatan Peninsula, Huasteca, and Chiapas. There is pressure to get other GM crops currently in the experimental and pilot pipeline (corn and wheat) approved for commercial use. Corn remains the most sensitive, due to Mexico being the center of origin. In 2013, the Mexican government approved test pilot plantings of genetically modified corn for the state of Sinaloa only (Otero and Hansen, 2013). The evolving regulatory environment for genetically modified seed and their crops will affect marketing prospects of seeds (Hernandez, 2008).

In 2007, the government of Mexico enacted a new seed law, “Federal Law for Production, Certification, and Seed Trade”, as part of the 2007-2012 Seeds National Program (SNP), which established specific provisions regarding intellectual property protection for plant breeders in Mexico. In theory, the seed law helped seed importers by lowering restrictions on seed trade while giving plant breeders more protection in Mexico. The law also determines phytosanitary regulations for the importation of seeds and improves access to the Mexican market for US exporters (Hernandez, 2008). In 2007, Mexican Department of Agriculture, Secretaria de Agricultura Ganaderia Desarrollo Rural Pesca y Alimentacion (SAGARPA) stated that national producers should work toward improving worldwide productivity through technology, suggesting that the Mexican government is open to the use of hybrid seed.

The SNP has become the instrument and guide for improving and modernizing the seed industry in Mexico. One of the main goals of the SNP was to increase area of certified seed planted in the country from 33% to 45% by 2012 (Hernandez, 2008). The lack of spill-over

benefits related to decreased public research and development to small and medium size companies have elevated the cost of registering seeds and reduced demand for new hybrid seeds to be introduced. The SNP hopes to aid the productivity and competitiveness of the seed sector through active organization of producers and suppliers to provide a consistent and ample supply of competitively priced quality seeds (Hernandez, 2008).

Greenhouse and Shade House Production

Whether through GH (glass, fiberglass, or plastic) or SH, PC production facilities continue to experience rapid growth. Flores and Ford (2010) observed PC in Mexico growing at about 10% a year as producers increasingly become aware of the benefits in production, quality, pest control, and reduced risk exposure to climate changes such as frosts. While there are approximately 30% more GH than SH structures, many producers throughout Mexico believe that both technologies can provide similar cultivation benefits. Moreover, the Mexican government sees potential in growing the use of PC in rural and poorer areas as a form of social and economic development (Flores and Ford, 2010). PC vegetables is an agricultural sector with high growth potential and, if managed correctly, installation of PC in rural areas can help reduce crime by raising standards of living through the generation of quality employment sources (Perea and Suarez, 2012).

Estimates of total land use devoted to PC cultivation vary; however, SAGARPA estimated about 20,000 Ha under PC in 2010, with 12,000 Ha of GH and 8,000 Ha of SH cultivation. The northern states of Baja California Norte, Baja California Sur, Sinaloa, and Sonora produce over half of PC in Mexico, with 22% of total PC operations concentrated in Sinaloa (Flores and Ford, 2010). PC infrastructure is mostly devoted to tomatoes, cucumbers, bell peppers, and strawberries.

Figure 2. Concentration of Protected Culture Crops in Mexico. Source: Salzar, 2010.

The Mexican government is striving to build its international export base of PC fruits and vegetables and is expected to reach 50,000 Ha of PC by 2020 through funding and education provided by SAGARPA and the Mexican Association of Protected Culture (AHMPAC) (Salazar, 2011). PC output is almost exclusively exported because of higher prices it commands. Export markets for higher-valued PC crops exist within countries having higher average incomes and strict import standards because quality and safety standards are easier to attain in the more controlled environment. PC can also command a high price by serving niche markets in winter months to countries unable to harvest crops due to inhospitable growing conditions.

The ability to achieve higher prices makes PC an appealing option for farmers already serving export markets, particularly those located close to the US border (Flores and Ford, 2010). The US is the primary market for NW Mexico products grown under PC with main exports being tomatoes, bell peppers, cucumbers, and eggplants. Growers are continuing to export larger quantities of PC each year to other global markets as well, with the great majority

of fresh vegetable exports consisting of tomatoes, cucumbers, and peppers, similar to the export patterns of the US (Salazar, 2011).

Figure 3. High Technology Greenhouse in Sinaloa, Mexico. Source: Manjarrez 2013.

PC operations in Mexico can range in size from smaller cooperatives with 12- 15 farmers cultivating 1 to 10 Ha to larger companies cultivating 10+ Ha (Manjarrez, 2013). Most producers use basic plastic PC structures, with the decision for type based primarily on the specific climatic conditions of the region. PC inputs can vary from lower technology SHs that cover crops planted in fields to higher technology, active-environmental-control GHs using hydroponics. While GH technology is utilized slightly more often, SH use is becoming more popular due to lower costs of technology and capital infrastructure inputs (Manjarrez, 2013). The majority of these infrastructure installations have drip irrigation systems, insect/anti-aphid protection, and systems to control light and air (see Figure 3). Other higher technology systems may include glass structures with heating, illumination systems and controlled CO₂ usage, and

are most likely to be located in the northern states of Sinaloa, Baja California Norte, and Sonora (see Figure 4) (Perea, 2010). The central states have the advantage of producing year-round, whereas northern states produce mainly over winter season and remain dormant June to August when temperatures are the highest.

Figure 4. Protected Culture Sites. Source: Perea 2010.

The boom in GH construction that has occurred in the last decade has led to successes and failures. High levels of abandonment are most commonly caused by farmers switching to PC without understanding investment requirements including a need for strong distribution channels and an awareness of produce market trends. In 2010, SAGARPA reported that in previous years, financial failure of GHs in some regions, most notably Sonora, led to abandonment rates as high as 40% owing to the lack of training of producers combined with market price decline and producers not knowing how to quickly respond to market changes. Most problems exist in the Southeast region, where growth is at a slower pace, distribution

channels to export markets are not strong, and there is less knowledge and experience of PC cultivation expertise (Perea, 2010). During the First National Forum for Greenhouse Builders (July 2009) in Sinaloa, President of the Mexican Association of Protected Horticulture (AMHPAC - Sinaloa), Viramontes Serralde, highlighted the need to switch from trading with border dealers (bookers and wholesalers) to contract selling with end marketers. He also discussed market saturation of PC, which has the potential to lower seasonal product prices in domestic and export markets. With 25 producing states of the country all striving to sell to the three known commercial paths of Texas, Arizona and California, the markets have become saturated. The high fungibility of fresh produce consequently means border distributors need to move the product quickly, lowering prices when volumes exceed demand in order to move the product, which translates to a lower price for Mexican growers. With practice and time, Mexican farmers are learning how to determine when domestic terminal markets will return the best prices and how to more precisely respond to market demands in order to better balance the supply-demand relationship between vegetable export markets and domestic producers, but further coordination between export vegetable entities seems appropriate (Perea and Suarez, 2012).

Unlike other sectors of the economy including OF agriculture, PC production needs to achieve higher yields to avoid bankruptcy due to the high capital inputs including start-up construction costs and higher energy use requirements. Now producers are advised by lenders to secure a contract market before investing in PC technology, as product demand, along with crop characteristics and climatic conditions of the location determine what type and size of PC facilities must be built (Perea and Suarez, 2012). Contract marketing is becoming the norm in the PC industry because PC offers a more stable crop market demand while ensuring a consistent income source, which lowers the risk of costly infrastructure investments (Salazar, 2011).

If managed correctly, PC is an agricultural sub-sector with high growth potential. The ability to cultivate crops in a wider variety of climates allows for the creation of niche markets

where high-value can be achieved during foreign off-seasons. PC also uses up to 50% less water which is becoming a relevant factor in farming considering that global changes in weather patterns have led to apparent drought situations in Mexico. Less temperature, evaporation, and precipitation dispersion control causes OF farmers use twice as much water as PC farmers, and are therefore more susceptible to the increased incidences of drought associated with global warming that are being seen in Mexico (Salzar, 2011). In 2012, 18 of the 32 Mexican states were affected by the country's worst drought on record, causing food production to decline by 40% (Tegel, 2012). Producers, builders, and government officials agree that many farmers ventured into PC production without sufficient knowledge, planning, or training. This has created market saturation in certain crops and inefficient distribution channels leading to farm abandonment. A broader set of management skills for PC is crucial to ensure success of the PC industry in Mexico.

Tomatoes

A relatively small group of export-oriented, high-yielding producers serve as the main suppliers of tomatoes for both export and domestic use. These producers predominantly located in Sinaloa and Sonora made up approximately 70% of Mexican fresh tomato exports, while Baja California Norte accounted for most of the remainder. The growing importance of PC in the Mexican tomato market is evidenced by the shrinking role of OF tomatoes, which once dominated the US tomato supply (Calvin and Cook, 2005). The bulk of Mexican field growers who converted to PC are located in Sinaloa and the Baja California peninsula. Between 1990 and 2011, OF cultivation space devoted to tomatoes in Mexico dropped from 85,500 Ha to 57,000 Ha (Flores and Ford, 2010). The decrease in OF area is more evident in states like Sinaloa, Baja California Norte, and Jalisco where total planted area for tomatoes has been

steadily declining, but yields have been increasing due to the establishment of PC. New technologies utilized in PC opened the door for additional tomato production, some from areas where OF cultivation was limited. In 2005, US, Mexican, and Canadian growers produced nearly equal amounts of PC tomatoes for the US market. Since then, production has increased in all three countries, but Mexico has emerged as the dominant supplier to the US, with 62% of the volume in the US market in calendar year 2010 (Flores and Ford, 2010).

Thornsbury and Jerardo (2012) reported that more than 13,000 Ha of PC throughout Mexico was devoted to tomato production in 2011 (almost 70% of all PC), up from less than 10% in 2004. The retail and food service markets for OF tomatoes have declined sharply in favor of PC, desiring the more consistent product characteristics PC provides. The transition to PC tomatoes is likely to accelerate if US convenience food consumption continues at its current rate and growers strive to meet foodservice demand, particularly from fast food buyers (Thornsbury and Jerardo, 2012).

Regional Cultivation

Sinaloa's fruit and vegetable crops are irrigated, with water being supplied by dammed mountain streams and rivers, allowing for abundant and varied crop cultivation. Top crops produced overall include green tomatoes, red tomatoes, chilies, potatoes, watermelon, papaya, oranges, and mangoes. Sinaloa is also the main producer of export vegetables in the country (Stout, *et al.*, 2002). Areas identified for expansion are melons, cucumbers, and chilies, with tomatoes, onions, and squash hitting saturation points (SFA, 2011). Historically, the state of Sinaloa has exported during the winter and early spring months because of the natural opportunity to market when US market supply was lower and products command higher prices (Manjarrez, 2013).

The export fruit market dominates Sonora production. Major vegetable and fruit crops include watermelon, potatoes, melons, pumpkins, watermelon, asparagus, oranges, grapefruit, and grapes. Potential expansion exists in lettuce, cucumber, melon, asparagus, chilies, and melon crops. Saturated markets are broccoli, red tomatoes, onions, and watermelons (SFA, 2011). The Yaqui Valley of Sonora established a planting area of just over 10,000 Ha of PC for the 2012-2013 crop year with the majority of cultivation devoted to chilies, tomatillos, squash, tomatoes, onions, and watermelons because of the high, stable prices these commodities command. The major crop being established for the 2013-2014 crop year is the potato with 5000 Ha being planted. Unlike Sinaloa, Sonora does have water problems because it relies on seriously overdrawn aquifers for irrigation. OF cultivation could lose acreage to less water-intensive PC in the face of future water scarcity issues (Stout, *et al.*, 2002).

Ranked as Mexico's 13th largest agricultural producing area, Baja California Norte produced 2.4% of the nation's agriculture by value. Major cultivated crops for 2010 included onion, strawberries, chilies, cucumbers, oranges, grapes, and red tomatoes. The only crops showing expansion opportunities for 2012 were peaches and grapes. Markets saturated with producers were tomatoes, onions, strawberries, and broccoli (SFA, 2011).

Ranking last in overall agricultural production was Baja California Sur, with agricultural cultivation only contributing 0.3% in 2011 to the overall national total. Major fruit and vegetable crops for 2011 were avocado, asparagus, mango, strawberries, and oranges. Recent areas of expansion identified by the government were melons, grapes, chilies, lettuce, and cucumbers. Mango, papaya, and squash were determined to be a saturated market with little room for regional growth (SFA, 2011).

Chapter 3

METHODOLOGY

Procedures for Data Collection

The NW states of Mexico (Baja California Norte, Baja California Sur, Sinaloa, and Sonora) comprise a region of particular interest for the seed sales industry because of their substantial seed-based vegetable industry and higher concentrations in GH and SH production. GH-SH technology lends itself to the use of high quality seed market opportunities because they export to international consumers which demand superior products. Of particular interest are brassica vegetable crops because of the need for seed planting each season as opposed to fruit trees or perennial crops, such as asparagus, which can produce for many years on one successfully planted seed. Crops identified as “key” crops of interest by AIS (2008) were bell pepper, broccoli, carrot, cauliflower, chilies, cucumber, lettuce, tomatoes, onion (green), onion (bulb), spinach, and squash.

Information on cultivation method, hectares cultivated, tons produced, and farm gate value was gathered for 12 seed-based vegetable crops from 2003-2013 to determine the stronger seed market opportunities of NW Mexico and to identify historical trends (see Appendix Table 1). Cultivation, production, and value data was further analyzed by each state in the NW region (Baja California Norte, Baja California Sur, Sinaloa, and Sonora) to identify regional trends more precisely. Data was retrieved from an online database supplied by the Mexican Department of Agriculture, SAGARPA, which collects agricultural statistics in order to accurately

apply programs offering financial and technical assistance to farmers. The information held by SAGARPA is validated by the Mexican Information Service of Food and Fisheries² (SIAP-Federal District, Government of Mexico - GOM) to ensure accuracy. Values were converted from pesos to dollars using monthly international currency conversion rates reported by the US Department of the Treasury (2013) and annualized to obtain present values in nominal dollars (2013 \$)³.

Procedures for Data Analysis

Data was entered into Excel™ to create “pivot tables” to organize cultivation, production, and value numbers by state and crop. Values were analyzed to determine larger markets by crop and geographic area. Percentage change in cultivated area, production, and value from 2003-2012 was calculated to identify change over the 10 year period. Further, 2003 was used as a base year for OF and GH, and 2007 for SH as this was the first year data was reported by SAGARPA. Looking at annual and base year percentage changes over time as opposed to actual production numbers allowed for relative comparison across commodities experiencing very unequal cultivation sizes of vegetable production.

Cultivated Area Trends

National and aggregated NW states cultivated area (Ha) data for OF, GH, and SH use was averaged together for 2010-2012. A three year average of 2010, 2011, and 2012 provided a more stable view, which reduced the effect of a single season fluctuation of crop cultivated

² SIAP works to provide transparency throughout the Mexican government through information audits

³ Peso to US (\$) Conversion: 2003-10.79, 2004 -11.29, 2005-10.82, 2006-10.90, 2007-10.93, 2008-11.14, 2009-13.50, 2010-12.63, 2011-12.43

area. Total cultivated Ha of the NW region was then compared to the national average to determine the cultivated share by method each NW state held of the national total which could suggest a high cultivation type share and a high geographic market concentration.

NW Mexico vegetable percent change in cultivated area was examined by crop and method to identify trends in OF and PC cultivated Ha over time in the region. Crops showing consistent increases in cultivated area by type could indicate burgeoning demand or potential for market growth. Crops showing a consistent decline in cultivated area could point toward potentially saturated markets or current market trends due to changes in the industry. Frequency distributions were used to compare crop cultivation based on cultivated Ha on a state level to determine the most active NW vegetable markets by state. Each area listed the crop by state and the percentage of total cultivation that was devoted to each crop to identify the highest potential for seed sales by locality. Again, a three year average of 2010, 2011, and 2012 was used to provide a more stable view, reducing the effect of single seasonal fluctuations of crop cultivated area.

Each key crop cultivated area average in NW Mexico for 2010-2012 was compared to the national average, and crops holding at least 1,000 Ha were further analyzed to see changes and emerging trends in cultivated area over a 10-year period. This could help identify if states were devoting proportionately more or less cultivated space to the key crops than their proportionate amount of arable land would suggest and to identify proportionately larger or smaller market shares or intensities.

The FORECAST function (FORECAST(x, known_y's,known_x's)) was used in Excel to obtain a least squares linear regression to determine trends of future cultivation to 2017. The forecast used the prior 10 years data to estimate prices for 2013, and then a moving or rolling 10-year average including the forecasted years prior for years 2013-2017. The equation used was $y = a + bx$ where x was the time period in years and y is the total cultivation in Ha by year for OF cultivated area. In cases of greenhouse and shade house cultivated area, the x-intercept

was set at 0, assuming no greenhouse or shade house cultivated area existed in the base year. The p-value was used to judge if the trend was statistically significant and the R^2 value was used to determine how much of the variation in cultivated area was related to a time trend.

Farm Gate Value Trends

Total value in dollars was analyzed to observe monetary trends in farm gate value based on method of production and crop to determine potential market value. Quality seeds come at a premium price which is often not worth paying for low-valued crops. Producers of higher-valued crops may be more likely to utilize more expensive inputs such as quality seed because of the higher farm gate value that can be expected.

Farm gate value for the 12 key crops was aggregated from each of the four states - Baja California Norte, Baja California Sur, Sinaloa, and Sonora, and compared to the national farm gate value to determine what percentage of value the NW region as a whole held in comparison to the national total. NW regional data was compared to national data to determine high regional concentrations of higher valued key crops compared to the national total. These values by were further broken out by OF and PC categories to see individual crop values by method.

Production Level Trends

Production and farm gate value per Ha was calculated by cultivation method to determine differences in yield and value between OF and PC types. By identifying the highest producing crops by tonnage, one can more accurately identify the actual amount of seed a current market is utilizing and producing from. This is especially important in PC where the actual cultivated hectares used may not accurately reflect seed usage because of the more

concentrated planting efforts and the ability to produce for longer seasons than in OF farming. While cultivation numbers provide good indicators of the amount of land used to grow crops, looking at production allows one to determine general differences in each cultivation method and justifies findings in decreased cultivated area due to improved technology. Yields per Ha were calculated by taking total annual production tonnage and dividing it by cultivated Ha separately for OF, GH, and SH cultivation (ton/Ha). Farm gate value per Ha was calculated by dividing total crop value by total cultivated Ha separately for OF, GH, and SH cultivation (\$/Ha). Farm gate value per ton was calculated by dividing total farm gate value by crop yield separately for OF, GH, and SH cultivation (\$/ton).

Variance provides a quantified estimate of the level of risk associated with the uncertainty of future returns of yields and value by cultivation type. The relative variance in yields and value by cultivation method can help determine if cultivation methods vary in crop risk and by how much. A coefficient of variation (COV) was calculated to compare variance amongst cultivation types to provide a relative base despite very different production means. As the variance increases, the coefficient of variation (COV) becomes larger, which signifies a less stable base of production and more risk (Arjun, 2003). A standard deviation of a sample population⁴ (STDEV.P) and average of yield and farm gate value were used from 2008 to 2012 to calculate the (COV) between cultivation methods.

Assumptions

This study assumes annual crop reports and census surveys completed by SAGARPA accurately capture the majority of agricultural producers in Mexico and that the production and value data are true and consistent with the real market situation. GH and SH usage is likely to

⁴ The standard deviation for a sample population was chosen instead of a standard deviation of the entire population to achieve more conservative results.

be higher than official reports state because of incomplete information being reported, especially in the cases of PC which has just recently begun to be captured. In the SAGARPA dataset, there is no reported SH usage prior to 2007. More likely than not, the practice was in place prior to 2007; however, this study assumes no shade house cultivation was in place prior to reporting in 2007. In the SAGARPA dataset, there is no reported usage of greenhouses prior to 2003. This study assumes no greenhouse cultivation was in place prior to reporting in 2003.

Chapter 4

FINDINGS

Cultivated Land Use Trends

The main research question was to determine the size and concentration of cultivated area devoted to the key brassica-based vegetable crops in the NW region of Mexico. The NW region made up almost 19% of total national cultivated Ha for the identified key crops for 2010-2012 (see Table 1). OF cultivation made up 86.6% of total NW cultivated area, while PC was much smaller, split fairly evenly with 6.4% devoted to GH production and 7% devoted to SH. Although NW open field cultivated land area was proportional to national open field cultivated area, the NW region held a disproportionate share of the land area dedicated to PC claiming 53% of the national GH cultivated Ha and 98% of reported SH cultivated Ha, making the region the most densely concentrated area of PC in Mexico (see Table 1). Specifically, Sinaloa was the biggest producer in the region for all cultivation methods despite being the smallest state geographically. Sinaloa represented 11.6% of the national land total in the key crops investigated while only occupying 2.9% of total land mass in Mexico (see Table 1) suggesting a high specialization in the cultivation of key crops and a high geographic market concentration.

Table 2 displays percentage changes in cultivated area since 2003. The data suggest measureable GH vegetable cultivation began in Mexico in 2003 and has seen exponential growth in cultivated area to 2012. Shade house cultivated area has also seen large growth since being introduced in 2007. As demonstrated in Figure 5 on the following page, the majority

of land devoted to OF cultivation from 2003-2012 declined in all states other than Sonora, which stayed relatively the same; however, states correspondingly saw increases in PC cultivated area during the same time period. OF cultivated area is being replaced by PC production in select crops and regions. This may be due to the increased presence of GH and SH cultivation and reflects industry technology adoption from OF to PC with its substantially higher yields as will be seen subsequently.

Table 1. Average Hectares (Ha) Cultivated for Crops Investigated in NW States of Mexico: 2010-2012 for Total OF, GH, and SH.

Region Average (2010-2012)	Total Land Area Ha	% of MX	All Ha	OF Ha	% of MX	GH Ha	% of MX	SH Ha	% of MX
Mexico	1,960,246	-	352,512	338,313	-	8,903	-	5,296	-
Baja Norte	71,446	3.6%	13,647	12,003	3.5%	257	2.9%	1,387	26.2%
Baja Sur	73,922	3.8%	4,264	3,711	1.1%	191	2.1%	426	8%
Sinaloa	57,377	2.9%	41,046	34,272	10.1%	3,535	39.7%	3,239	61%
Sonora	179,503	9.2%	14,945	14,051	4.2%	761	8.5%	133	2.5%
Total	382,248	19.5%	73,900	64,037	18.9%	4,743	53.3%	5,184	97.9%

Source: SAGARPA Crop Database by State (2010-2012).

Table 2. NW Mexico Vegetable Cultivation Areas (in Ha) by Method: 2003-2012.

Year	Open Field		Greenhouse		Shade House	
	Cultivated Area (Ha)	% Change from 2003	Cultivated Area (Ha)	% Change from 2003	Cultivated Area (Ha)	% Change from 2003
2003	88,828	-	90	-	NPCR	-
2004	93,967	6%	326	264%	NPCR	-
2005	89,225	0%	499	458%	NPCR	-
2006	85,357	-4%	911	918%	NPCR	-
2007	87,851	-1%	932	941%	196	-
2008	70,884	-20%	502	461%	106	-54%
2009	63,399	-29%	631	605%	2,263	1155%
2010	67,480	-24%	1,556	1639%	4,048	2065%
2011	64,761	-27%	2,757	2981%	5,486	2799%
2012	59,676	-33%	9,917	10981%	6,145	3135%

Source: SAGARPA Crop Database by State (2003-2012) NPCR- No Protected Culture Reported.

Figure 5. NW Cultivated Ha by State and Method: 2003-2012. Source: SAGARPA (2003-2012).

Figures 6 and 7 illustrate the changes in crop cultivation from 2007 (see Figure 6) when SH technology began being recorded to 2012 (see Figure 7). Each dot symbolizes a particular crop grown in a particular state. The size of the dot is consistent with the relative size of cultivated area by crop. The color of the dot represents the method of cultivation with OF being green, GH identified as red, and SH identified as blue. Some crops have more than one green dot, which signifies a sub-category within OF, such as organic or a particular variety (such as roma in the case of tomatoes). Bell peppers, cucumbers, and tomatoes experienced prominent switches to PC cultivation over the last five years from 2007 to 2012; however, OF cultivation still held the majority of the land area cultivated in 2012. Small crops only grown via OF, such as broccoli, carrots, and cauliflower, showed very little variation in size of crop cultivated Ha or location over time. This figure also illustrates Sinaloa's dominance clearly is in bell peppers, chilies, squash and tomatoes, while Baja California Norte dominates in both onion types.

Farm Gate Value Trends

Mexico had a three year average aggregate farm gate market value (2010-2012) of just over \$3 billion for the key vegetable crops (see Table 3 on page 33) for domestic and export. The NW region three year average was nearly \$1.2 billion in sales for the same time period (see Table 4 on page 33). Although the NW region only held 18.9% of the cultivated area, the market value was 38.4% of the national total, suggesting the region has disproportionately greater sales, most likely due to the prevalence of PC products higher yields and prices. Crops, in order of largest farm gate value, were tomatoes, chilies, cucumber, bell pepper, onion (green), squash, onion (bulb), lettuce, broccoli, carrot, cauliflower, and spinach. The most lucrative production areas were those that used multiple cultivation methods, making high

Figure 6. 2007 Crop Ha by Method and State. Source: SAGARPA (2007).

Figure 7. 2012 Crop Ha by Method and State. Source: SAGARPA (2012).

Table 3. Average Values of Mexican Vegetable Crops: 2010-2012 (in \$1000's).

Crops	Open Field	Greenhouse	Shade House	Sum of Average Cultivated Area 2010-2012
Tomato	\$ 522,858	\$ 382,304	\$ 140,686	\$ 1,045,848
Chilies	\$ 856,533	\$ 35,654	\$ 161	\$ 892,348
Onion	\$ 301,381	NPCR	NPCR	\$ 301,381
Cucumber	\$ 95,889	\$ 41,825	\$ 38,006	\$ 175,720
Squash	\$ 149,044	\$ 467	\$ 95	\$ 149,607
Bell Pepper	\$ 65,302	\$ 38,135	\$ 38,428	\$ 141,865
Broccoli	\$ 118,629	NPCR	NPCR	\$ 118,629
Lettuce	\$ 78,582	\$ 151	NPCR	\$ 78,732
Onion (Green)	\$ 75,748	NPCR	NPCR	\$ 75,748
Carrot	\$ 67,425	NPCR	NPCR	\$ 67,425
Cauliflower	\$ 20,367	NPCR	NPCR	\$ 20,367
Spinach	\$ 7,052	NPCR	NPCR	\$ 7,052
Grand Total	\$ 2,358,810	\$ 498,536	\$ 217,376	\$ 3,074,722

Source: SAGARPA Crop Database National Level (2010-2012)

Table 4. Average Value of NW Mexico Regional Crops: 2010-2012 (in \$1000s).

Crops	Open Field	Greenhouse	Shade House	Sum of Average Cultivated Area 2010-2012
Tomato	\$ 259,857	\$ 95,446	\$ 138,080	\$ 493,383
Chilies	\$ 170,455	\$ 22,643	\$ 106	\$ 193,205
Cucumber	\$ 45,347	\$ 35,369	\$ 43,687	\$ 124,403
Bell Pepper	\$ 57,990	\$ 16,462	\$ 44,253	\$ 118,705
Onion (Green)	\$ 84,741	NPCR	NPCR	\$ 84,741
Squash	\$ 75,790	\$ 297	\$ 97	\$ 76,184
Onion (bulb)	\$ 30,116	NPCR	NPCR	\$ 30,116
Lettuce	\$ 26,046	NPCR	NPCR	\$ 26,046
Broccoli	\$ 18,955	NPCR	NPCR	\$ 18,955
Carrot	\$ 4,882	NPCR	NPCR	\$ 4,882
Cauliflower	\$ 2,643	NPCR	NPCR	\$ 2,643
Spinach	\$ 2,584	NPCR	NPCR	\$ 2,584
Grand Total	\$ 779,406	\$ 170,217	\$ 226,224	\$ 1,175,847

Source: SAGARPA Crop Database by State (2010-2012)

annual values likely due to the longer harvest seasons and higher production yield and value (see Figure 8). All Mexican tomatoes were correspondingly the largest revenue crop averaging a farm gate value over \$1 billion annually and the NW comprised almost half of the entire national farm gate value, NW chilies, cucumbers, and bell peppers averaged between \$100 million and \$200 million in farm gate value (see Table 3 and 4).

As demonstrated in Table 5, the last 5 year average (2008-2012) OF key crop farm gate value was \$13,683/Ha, while PC value was triple that, with SH value per cultivated area at \$43,267/Ha, and GH crops averaging the highest farm gate value per Ha at \$53,780 /Ha. Despite having higher per Ha farm gate value, lower capital input costs in a scarce capital period (due to the financial world crisis in 2007) could be a reason for increasing usage of SH cultivation despite better financial performance with GH technology. When analyzing value/Ha, GH crops commend a slightly higher price of \$598/ton compared to SH crops fetching \$593/ton; however, GH value/ton COV for GH was three times higher (0.27) than SH (0.09), signifying significantly more risk for very little change in farm gate value (see Figure 5). This is also the case for value/Ha, which shows a COV of more than double for GH (0.35) than SH (0.15). The additional \$5/ton most likely does not warrant the additional costs associated with more capital intensive GH construction and maintenance combined with higher risk.

Production Level Trends

An average yield was calculated for 2008-2012 to determine different production capabilities. As can be expected, OF vegetable yields were substantially lower than that of GH. An average yield was calculated for 2008-2012 to determine different production capabilities. As can be expected, OF vegetable yields were substantially lower than that of GH or SH, with

Figure 8. Average Values of Crops. Source: SAGARPA (2010-2012)

PC consistently producing yields two to five times higher than that of OF (see Table 5). OF yields averaged 29 Tons/Ha cultivated compared to 73 Tons/Ha for SH cultivation and 90 Tons/Ha for GH cultivation (see Table 5). GH cultivation provided the highest yield most likely associated with its higher protection for plants from weather, pests, and disease. Higher yields signify less environmental risk associated with cultivation which is reflected in the lower ton/Ha COV for PC, signifying more stable and consistent yields by Ha. The COV for \$/Ha and \$/ton was highest for GH, most likely because the industry saw large changes for a relatively small population, as crops switched from GH to SH use. Values have also consistently declined for GH production as SH production has increased, signifying a possible substitution in the market for a lower-priced product. Producers may also be switching to SH because it seems to portray less associated risk (lower COVs) with lower capital investment than GH and higher farm gate value over OF.

Table 5. Yield and Value by Ha for Cultivation Method 2003-2012.

Yield (Ton/Ha)				Value (\$/Ha)			Value/Ton (\$/Ton)		
Year	OF	GH	SH	OF	GH	SH	OF	GH	SH
2008	36	107	63	\$16,622	\$83,685	\$42,033	\$462	\$782	\$667
2009	33	79	79	\$15,378	\$54,759	\$41,533	\$466	\$693	\$526
2010	32	94	85	\$15,187	\$62,056	\$54,511	\$475	\$660	\$641
2011	17	74	57	\$8,790	\$36,345	\$34,749	\$517	\$491	\$610
2012	27	96	81	\$12,440	\$32,056	\$43,505	\$461	\$334	\$537
5 year avg.	29	90	73	\$13,683	\$53,780	\$43,267	\$472	\$598	\$593
Std dev 08-12	6.7	12.0	11.0	\$2,802	\$18,653	\$6,381	\$21	\$160	\$56
COV	0.23	0.13	0.15	0.20	0.35	0.15	0.04	0.27	0.09

Source: SAGARPA Crop Database by State (2008-2012)

NW Region Open Field Crops

Bell peppers, broccoli, chilies, cucumbers, lettuce, onions (bulb), onions (green), squash and tomatoes all held sizeable cultivated areas in NW Mexico, with tomatoes, squash, onions (green), and bell peppers possessing a substantial share (over 35%) of Mexican production (see Table 6). Carrots, cauliflower, and spinach all had low cultivated area totals suggesting less market opportunities in the NW states. In general, most key crops have declined in OF cultivated Ha from 2003 to 2012, with the exceptions of bell peppers, carrots, and lettuce (see Appendix Table1). Cauliflower had declining cultivated area and value suggesting less revenue opportunity (see Appendix Table1). Although carrots had low cultivated area, carrots were one of the few crops in which OF yield and farm gate value increased from 2003 to 2012. Specifically, Sonora had a 71% increase in cultivated area (454 Ha) and a 202% increase in value from 2003 to 2012, now comprising almost a \$3 million farm gate value (see Appendix Table 2). Increases in value outpaced increases in cultivated area, and may indicate an under saturated market (excess demand) and possible new sales, where farmers may be interested and encouraged to invest in carrot cultivation.

Table 7 (see page 41) presents the OF cultivation by individual crop distribution across the four northwestern states. Each box contains a frequency percentage for a crop and state. The first row of the cell contains a count of how many cultivated Ha exist for that crop in that particular region. In the first cell of the Bell Pepper column, the value “63” represents 63 Ha of cultivated space devoted to bell peppers in Baja California Norte. The second row is the total percentage a crop made up of the overall (multi-state) cultivated area. Bell peppers, a minor crop in Baja California Norte, held 0.03% of total cultivated area for the four states. Row three is column percentage which identifies what percentage of a particular crop is cultivated in a particular state. Crops with cultivated area moderately concentrated in one or two states, between 35-80%, were highlighted in yellow. Even stronger concentrations of crop cultivation

with 80-100% of cultivated area concentrated in one states are highlighted in pink. For example, area of cultivated bell pepper is primarily concentrated in Sinaloa, which makes up 93% of total bell pepper cultivation in the NW region. The fourth row signifies the percentage a crop makes up of the state total cultivation. Bell pepper cultivated area makes up 0.17% of Baja California Norte's total cultivated area as a state. The last columns give the total cultivated area for all crops combined for each state and the total percentage each state makes up of the regional cultivated area, which is highlighted in green.

When analyzing the distribution of crops across states, crop cultivation appears to be best suited to particular regions, with monoculture intensity especially concentrated in Sinaloa. For example, tomatoes and chilies made up over one half of the cultivated area while the remaining cultivated area was split across the eight crops (see Table 7). This could indicate a sub-sector of Sinaloan crop specialty growers.

Table 6. Reported NW Mexico Cultivated Land Area (Ha) of Key Crops: Average of 2010-2012.

Average Cultivated Ha 2010-2012	MX Open Field	NW Open Field	% of Total MX	MX Green-house	NW Green-house	% of Total MX	MX Shade House	NW Shade House	% of Total MX
Tomato	45,037	17,140	38%	6,772	3,076	45%	2,916	2,815	97%
Chili (green)	139,699	16,003	12%	553	442	80%	5	3	69%
Squash	28,007	10,836	39%	22	13.80	63%	4	3	83%
Onion (green)	6,603	5,765	87%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Bell pepper	4,421	3,711	83%	672	478.60	71%	1,213	1,211	99%
Cucumber	14,033	3,123	22%	880	732	83%	1,158	1,152	100%
Onion	39,452	3,002	8%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Lettuce	17,513	2,104	12%	3.35	0.02	0%	NPCR	NPCR	NPCR
Broccoli	24,157	1,298	5%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Carrot	14,144	613	4%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Spinach	1,606	214	13%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Cauliflower	3,641	164	5%	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
Total	338,313	63,973	19%	8,903	4,743	53%	5,296	5,185	98%

Note: MX is Mexico; NW is Baja Norte, Baja Sur, Sinaloa, and Sonora combined. Source: SAGARPA Crop Database by State (2003-2012) = Substantial Concentration (35-80%) = Dominant Concentration (80%+)

NW Region Protected Culture Crops

With the exception of onions (green), the top five crops showing largest spaces devoted to OF, also showed the highest use of PC (see Table 4). Substantial concentrations of PC production area (more than 35% of all Mexican cultivation share) exist for five of the twelve key crops of interest, bell pepper, cucumbers, chilies, squash, and tomatoes, (see Table 6). This maintains consistency that even if cultivation methods are different in NW Mexico, specific crop cultivation is still very evident in tomatoes, chilies, squash, bell peppers, and cucumbers. PC bell pepper, chilies, cucumbers, and tomatoes are all produced in larger quantities than other Mexican production areas; however, GH production of these crops is still substantially smaller than OF cultivated area (see Figure 5).

Recorded GH Ha in the NW region has seen a high rate of change, growing from from 90 Ha in 2003 to 9,790 Ha in 2012 (a 10,980% increase). The greatest GH growth from 2010 to 2012 was in Sinaloa, which reported increased GH usage for bell peppers rising to 1,128 Ha (540%), cucumbers to 1,186 Ha(1,200%), and tomatoes to 6,102 Ha (2,440%), which when combined, made up 86% of total cultivated area (see Appendix Table 2).

Since its inception in 2007, SH production has gained in popularity for crops previously grown in GHs, with substantial shifts in bell peppers, cucumbers, and tomatoes to SH. Figure 9 displays cultivation by year and crop for the aggregated NW region, with PC represented as the top two categories atop the histogram spikes in red (GH) and green (SH). SH cultivated area in NW Mexico totaled 6,145 Ha in 2012, and like GH, Ha is mainly devoted to tomatoes (2,911 Ha), bell peppers (1,906 Ha), and cucumbers (1,318 Ha). Sinaloa had 3,667 SH Ha, or 60% of total national SH cultivation for the key crops. Baja California Norte also had a sizable SH tomato cultivated area of 1,500 Ha (see Appendix Table1). Baja California Sur and Sonora both held less than 1,000 Ha in both forms of PC in 2012, suggesting underdeveloped PC usage when compared to the other NW states.

Figure 9. NW Region Cultivated Ha by Crop: 2003-2012. Source: SAGARPA (2003-2012)

Table 7. Frequency Distribution: NW Open Field Cultivation by State and Crop: 2010-2012

Count Total % Col % Row %	Open Field												State Totals
	Bell Pepper	Broccoli	Carrot	Cauliflower	Chili (Green)	Cucumber	Lettuce	Onion	Onion (Green)	Spinach	Squash	Tomato	
BJ Norte	63 0.03 0.56 0.17	1191 0.62 30.57 3.31	569 0.30 30.95 1.58	249 0.13 50.41 0.69	1978 1.03 4.12 5.49	588 0.31 6.28 1.63	4802 2.50 76.09 13.34	4683 2.44 50.90 13.00	13256 6.90 76.64 36.81	553 0.29 86.14 1.54	2106 1.10 6.48 5.85	5973 3.11 11.62 16.59	36009 18.74 100%
BJ Sur	196 0.10 1.76 1.76	9 0.00 0.22 0.08	47 0.02 2.53 0.42	0 0.00 0.00 0.00	3845 2.00 8.01 34.54	163 0.08 1.74 1.46	42 0.02 0.66 0.37	364 0.19 3.96 3.27	0 0.00 0.00 0.00	0 0.00 0.00 0.00	725 0.38 2.23 6.51	5744 2.99 11.17 51.59	11134 5.80 100%
Sinaloa	10405 5.42 93.47 10.12	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	33694 17.54 70.18 32.77	7337 3.82 78.31 7.14	0 0.00 0.00 0.00	1896 0.99 20.61 1.84	0 0.00 0.00 0.00	0 0.00 0.00 0.00	13865 7.22 42.65 13.49	35620 18.54 69.27 34.64	102817 53.52 100%
Sonora	468 0.24 4.20 1.11	2696 1.40 69.21 6.40	1223 0.64 66.52 2.90	245 0.13 49.59 0.58	8491 4.42 17.69 20.14	1282 0.67 13.68 3.04	1467 0.76 23.25 3.48	2258 1.18 24.54 5.36	4039 2.10 23.36 9.58	89 0.05 13.86 0.21	15811 8.23 48.64 37.51	4084 2.13 7.94 9.69	42152 21.94 100%
Crop Totals	11132 5.79	3896 2.03	1838 0.96	493 0.26	48008 24.99	9369 4.88	6311 3.29	9200 4.79	17295 9.00	642 0.33	32507 16.92	51421 26.77	192112 100%

Source: SAGARPA State Database 2010-2012

Note: Cell Contents are:

- Row 1: Land area (Ha) tally
- Row 2: Crop % of total crops for NW region
- Row 3: Crop % as an individual crop for NW region
- Row 4: Crop as % of State's land area
- State Totals: % and Ha of cultivated area a state holds in NW region
- Crop Totals: % and Ha of cultivated area a crop holds in NW region

Color Key:

- = Substantial Concentration (35-80%)
- = Dominant Concentration (80%+)

Table 8. Frequency Distribution: NW Protected Culture Cultivation by State and Crop: 2010-2012

Greenhouse						
	Bell Pepper	Chili (Green)	Cucumber	Squash	Tomato	State Totals
BJ Norte	0 0.00 0.00 0.00	0 0.00 0.00 0.00	254 1.80 11.57 33.03	35 0.25 85.51 4.60	480 3.40 5.27 62.37	770 5.46 100%
BJ Sur	62 0.44 4.32 10.84	217 1.54 16.35 37.94	12 0.08 0.52 2.01	0 0.00 0.00 0.00	282 2.00 3.09 49.21	572 4.06 100%
Sinaloa	1374 9.74 95.68 12.95	0 0.00 0.00 0.00	1364 9.67 62.03 12.86	0 0.00 0.00 0.00	7869 55.79 86.45 74.19	10606 75.20 100%
Sonora	0 0.00 0.00 0.00	1110 7.87 83.65 51.47	569 4.03 25.88 26.37	6 0.04 14.49 0.28	472 3.35 5.19 21.88	2157 15.29 100%
Crop Totals	1436 10.18	1327 9.41	2198 15.58	41 0.29	9102 64.53	14104 100%
Shade House						
	Bell Pepper	Chili (Green)	Cucumber	Squash	Tomato	State Totals
BJ Norte	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1335 8.51 38.61 32.09	0 0.00 0.00 0.00	2825 18.02 32.96 67.91	4160 26.53 100%
BJ Sur	178 1.14 4.90 13.94	0 0.00 0.00 0.00	287 1.83 8.30 22.47	0 0.00 0.00 0.00	812 5.18 9.47 63.59	1277 8.14 100%
Sinaloa	3454 22.03 95.10 35.54	0 0.00 0.00 0.00	1634 10.42 47.26 16.81	0 0.00 0.00 0.00	4630 29.53 54.01 47.64	9717 61.97 100%
Sonora	0 0.00 0.00 0.00	10 0.06 100.00 1.90	202 1.29 5.83 38.31	10 0.06 100.00 1.90	305 1.94 3.55 57.89	526 3.35 100%
Crop Totals	3632 23.16	10 0.06	3457 22.05	10 0.06	8571 54.66	15680 100%

NW Region Cultivated Area Forecast

Five year cultivated area projections for 2013-2017 were completed in Excel (based on the SAGARPA data displayed in Figure 9) to determine future growth of identified crops. Linear regression was used to find the rate of change (slope) in cultivated area numbers by taking into consideration cultivation levels over time, and was then applied to future years (see Appendix Table 3). Not surprisingly, all OF cultivated areas with the exceptions of bell peppers, carrots, and lettuce were projected to decrease. OF bell peppers are forecasted to have large area share of total cultivation for 2013-2014, but then experience decline as PC grows larger in future years; however, the variability in OF cultivated Ha makes this prediction unstable (see Appendix Table 3 for best-fit equations and statistical significance). OF cultivated area of carrots is expected to grow at a rate of 24 Ha per year to 821 Ha in 2017; however, this is not a large absolute area increase and that increase in cultivated area and resultant production could easily be diminished by adverse environmental conditions, such as lack of water or frost. Environmental pressures would seem an important driver of PC adoption.

Lettuce was the only identified crop forecasted to have significant growth of 122 Ha a year in OF cultivated area, representing approximately a 30% increase in the next 5 years to almost 3,000 Ha. Both onion (bulb) and onion (green) OF cultivated areas could decline, with onions (bulb) projected to drop by 50% from 2013 to 2017. However, squash also declines which may be because OF cultivated area is being replaced with PC, but PC numbers were too low to give accurate predictions. Cauliflower and spinach cultivated areas, which were already negligible compared to other identified crops in the region, have declined since 2003; however, cauliflower and spinach cultivated area totals were too small to give accurate forecasting predictions, and with less than 200 Ha devoted to each, are not worth pursuing as possibilities for new market entry (see Appendix Table 2).

Figure 10. Forecasted Cultivated Area for Identified Crops: 2012 vs. 2017

OF cultivated area of tomato and cucumber is projected to almost disappear as PC takes over as the preferred method. Open-field cultivated area of tomatoes is expected to drop at a rate of almost 2700 Ha a year while greenhouse is expected to raise 249 Ha per year and shade house cultivated area is expected to increase at almost 4x that rate. The other major crop using PC, chilies, is experiencing a less dramatic decline in OF cultivated area while seeing a growth in GH cultivated area. GH cultivated area is expected to increase a little over 2,000 Ha and SH cultivated area is expected to more than double in size from 6,6136 Ha to 12,780 Ha.

State Specific Changes

Baja California Norte

Baja California Norte saw declines in OF cultivation from 2003 to 2012 of 5,281 Ha, dropping from 17,669 Ha to 12,388 Ha, representing a 30% decline, and yet OF cultivation still constituted over 87% of overall cultivated area for Baja California Norte in 2012. When looking at land area average of 2010-2012, OF production was heavily concentrated in onions (green), with Baja California Norte producing 70% (4,870 Ha) of the national land area total in 2012 (see Appendix Table 2) and 76% of the supply in the NW region (see Table 7) for the period of 2010-2012. In the NW region, the majority of onion (bulb) and lettuce cultivation land area has been located in Baja California Norte (see Table 7).

Although not large in cultivated area, GHs in Baja California Norte increased 518% from a reported 48 Ha in 2003 to 301 Ha in 2012, which was devoted mostly to tomatoes and cucumbers (see Appendix Table 4). Baja California Norte held 10.6% of total SH land area for the NW region. SH area increased substantially than that of GH, from 196 Ha in 2007 to 1,500

Ha in 2012, with the expansion devoted exclusively to red tomato and cucumber. This corresponds with a decrease in OF cucumber cultivated area from 869 Ha in 2003 to 149 Ha in 2012 and a decrease in tomato cultivated area from 5,601 Ha to 1,708 Ha (see Appendix Table 4). In contrast, SH tomato cultivated area has increased from no reported Ha in 2008 to 1,021 reported Ha in 2012. Because the productivity of GH and SH cultivation is two to three times higher than OF, the loss of 5,281 Ha from 2003 to 2012 actually translated to an overall production gain in both cucumber and tomato yields, with tons of cucumbers produced rising from 31.9 tons/Ha in 2003 to 62.1 tons/Ha in 2012 per annual harvest (see Appendix Table 4). Tomatoes also saw overall production yields climb from 44.5 tons/Ha in 2003 to 64.3 tons/Ha in 2012.

Baja California Sur

For the key crops of interest, Baja California Sur represents the smallest production region of the four states, accounting for only 5.8% of the total OF production on average for the key crops for the NW region and 3,453 Ha devoted to key crops in 2012, with the only “substantial” crop production attributed to chilies and tomatoes (see Table 7), which when combined, total 88.3% of OF Ha in Baja Sur (see Appendix Table 5). Although tomato and chili (green) cultivation made up the majority of OF cultivated area, Ha devoted to these crops has dropped 36% since 2003, which is proportional to the overall state decline in OF production. Baja California Sur saw overall declines in OF cultivation area of 38.7% from 5,631 Ha in 2003 to 3,453 Ha in 2012 (see Appendix Table 5), but because of the small cultivated area, this only represents an overall loss of 2,178 Ha, less than half of the loss in Baja California Norte discussed above.

GH use reached its peak usage during 2004 to 2007, averaging 326 Ha, but then saw instances of greenhouse abandonment (possibly due to economic decline) for the subsequent period of 2008 to 2012, lowering the devoted area by 158 Ha annually. While PC chilies remain primarily cultivated in GH environments (181 Ha for 2012), tomatoes and cucumber production have moved predominantly to SH. New for 2012 is the reporting of PC cultivation of bell peppers in Baja California Sur.

SH production is first reported in 2009 at 155 Ha and has grown to 718 Ha in 2012 (see Appendix Table 5), suggesting farmers switched to SH, primarily for cultivation of tomatoes and cucumbers. For example, in 2004 108 Ha was devoted to GH tomato production, but this number had dropped to 35 Ha in 2012 as SH tomatoes increased to 459 Ha in the same year. PC cucumbers, representing the second largest, but still much smaller market than tomatoes, has switched completely to SH with no reported GH cultivated area since 2010.

Sinaloa

Sinaloa is the chief producer of Mexican crops, holding 54% of OF, 75% of GH, and 62% of SH cultivated crop area for the NW region between 2010-2012 (see Figures 10 and 11). As with the patterns in other states, OF area in Sinaloa has decreased from 50,450 Ha in 2003 to 30,456 Ha in 2012, with most of the decreased cultivation in tomatoes (10,695 Ha), squash (5,287 Ha), cucumbers (2,838 Ha), and chilies (2,026 Ha) in the 10 year period. The only crop which increased in cultivated area was bell peppers, almost doubling cultivate area from 1,256 Ha to 2,425 Ha. Correspondingly, PC in Sinaloa showed huge areas of growth from 2009-2011. Prior to 2009, Sinaloa reported no data on Ha devoted to PC, but by 2012 GH area was reported at 8,415 Ha and SH at 3,667 Ha, making up 84% of GH and 61% of SH cultivation in

the NW Mexico region, and 55% of GH cultivated area and 59% of SH cultivated area nationally (see Appendix Table 5).

Similar to the other states, OF cultivated area had declined for the crops in which PC methods were subsequently employed. Total cultivated OF areas of tomato dropped 15% from 2003 (21,911 Ha) to 2012 (18,624 Ha); however, overall production of tomatoes increased from 991,100 tons in 2003 to 1,039,300 tons in 2012 (see Appendix Table 4). This is possible through the advanced yields produced by PC. Similarly, cucumbers lost 21% of area devoted to cucumber cultivation from 2003 (4,860 Ha) to 2012 (3,842), but increased in production tons 33% in the same time period, as PC expanded to make up almost equal OF production (see Figure 5).

Sonora

The state of Sonora is the second highest producing region in the NW, averaging 22% of OF (14,050 Ha), 15% of GH (719 Ha), and 3% (256 Ha) of SH crop area in the NW region for the time period of 2010-2012 (SH used an average of 2011-2012, the only years for which SH cultivated area was reported) (see Table 7). Sonora experienced an 11% decline in OF cultivated area from 2003 (15,078 Ha) to 2012 (13,379 Ha) as PC became more popular; however, this is the lowest reduction in OF Ha of the NW states. Despite declines in OF cultivation, Sonora has seen steady increases in GH production, increasing from 29 Ha in 2003 to 978 Ha in 2012 (see Appendix Table 5). GH production was focused on red tomatoes (177 Ha), cucumber (245 Ha), and chilies (553 Ha) with a reported 3 Ha devoted to squash in 2012.

The first reporting year of SH cultivation in Sonora was 2011, with almost equal land area devoted to tomatoes (127 Ha) and cucumbers (125 Ha). Chilies held a cultivated area of 5 Ha, which was small in comparison to overall SH cultivated area in the NW region, but did make

up the only space devoted to SH cultivation of chilies in the NW region for 2012 (see Appendix Table 4).

Major Changes in NW Vegetable Production

- The NW region declined in OF cultivated area by 29,000 Ha (from 88,828 Ha to 59,676 Ha) from 2003-2012, with almost 23,000 Ha of this decline attributed to crops also utilizing PC (bell pepper, chilies, cucumber, and tomato).
- The NW region increased PC cultivated area from 90 Ha to 15,937 Ha from 2003-2012 with the conversion of tomaotes, cucumbers, and bell peppers from OF to GH and SH cultivation.
- NW OF yield decreased by 835,000 tons from 2003-2012 (from 2,429,904 tons to 1,594,000 tons); however, PC yields (which are 2X to 3x higher than that of OF) increased from 19,103 tons in 2003 to 1,438,369 Ha tons in 2012, to make up almost equal production levels to that of OF despite using less than 1/3 the cultivated area.
- Producers have been converting from GH to SH since 2007, which is not surprising considering they held almost equal farm gate value (\$596/ton for GH compared to \$593/ton for SH) when averaged from 2008-2012, but GH production generally has higher input costs.
- Only Sinaloa and Sonora saw increases in production from 2003-2012 overall for all cultivation methods, with Baja California Norte and Baja California Sur declining in production tons.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In the NW region of Mexico, OF cultivated area is giving way to more technologically advanced cultivated methods of PC, decreasing by double that of the national rate of decline. Correspondingly, PC cultivated area in the NW region has increased relatively from 2003 to 2012 to offset the effect of declines in OF. SH use is becoming more popular, most likely due to the lower capital investments associated with it compared to GH use, especially in the NW region where SH cultivated area has outpaced GH cultivated area in growth. These changes demonstrate a trend away from use of OF cultivation to PC cultivation, most notably SH, and this trend is most predominant in the NW region.

OF and PC cultivated area of most crops was found to be very location specific to particular regions with monoculture present. Highly concentrated producer markets allow intensive crop development and promotion in particular regions. This is especially true for the main crops in the NW region, tomatoes and green chilies, making up over half of total OF and PC cultivated area. All crops had a substantial portion of their OF cultivated area (35-80%) occurring in only one or two states, with bell pepper, green chilies, cucumber, and tomato all having the majority of their cultivated area occurring only in Sinaloa. This made Sinaloa the top producer of OF cultivated key vegetables by far of the four states in the NW region, and displayed the most potential to expand the clientele base of AIS. Sonora, the state with the

second highest cultivated area, had substantial concentrations of broccoli, carrot, cauliflower, and squash cultivated area, but only squash was produced in any sizeable cultivated area. Sonora offers potential for market expansion because key crops can be grown here in larger numbers but are not currently. Baja California Norte only had about 1/3 size of OF cultivated area as Sinaloa but still had substantial crop concentrations of lettuce, onion (bulb), onion (green), and spinach, covering the majority of the rest of key crops that were not concentrated in Sinaloa or Sonora. Baja California Sur did not cultivate any sizeable land area of key crops.

PC cultivated area of the key crops was also found to be location specific to particular regions with monoculture present. Sinaloa, once again, held the majority of both GH and SH cultivated area with substantial crop concentrations of cucumbers, and a dominant crop concentration of bell peppers and tomatoes, making it the top producer of PC of the four states. Sonora had 15% of GH cultivated area with more than half the Ha dominated by green chilies. Baja California Norte had very little GH area but almost half the SH use of Sinaloa, mostly devoted to production of cucumbers and tomatoes. Baja California Sur did not hold any substantial cultivated area of key crops investigated for OF or PC, suggesting a market lacking in key crop vegetable producers, and thus, expansion opportunities.

Tomatoes, chilies, cucumbers, bell peppers, onions (green), and squash offered the largest base cultivation for both OF and PC and held the highest overall farm gate value of the crops investigated. These six key crops made up 92% of the total farm gate value for the NW region, with the other six crops, onion (bulb), lettuce, broccoli, carrots, cauliflower, and spinach, making up the remaining 8%. Of the top six highest valued crops, all utilized OF, GH and SH cultivation methods, with the exception of onions (green), suggesting the most lucrative crops, and those most likely to purchase expensive seed, are those engaged not only in OF but also PC production.

Conclusions

High levels of PC production in the NW region was most likely due to their strong market access that is proximity to the US border, their major market, as exports command higher prices. Export markets provide a more consistent demand, which accommodates nearly year-round cultivation of crops normally produced seasonally in OF environments. PC can also demand higher market prices because of the better quality, product consistency, and less crop loss due to environmental risks, which is reflected in the higher per ton value demonstrated from the research. This more lucrative and consistent market base enables investments in capital infrastructure and technology, such as hybrid quality seeds, for the production of PC.

When evaluating investments, investors should estimate both the expected return and the uncertainty of future returns in a mean variance analysis. When entering into or selling in emerging technology uses, PC production in this case, input suppliers must assess their levels of risk aversion and how willing clients, in this case, farmers are to invest in new markets. Cultivation associated with higher prices and less environmental risk is more likely to purchase expensive seeds because the risk of low yield returns is minimized and produce greater revenue and likely would improve profits of growers.

PC cultivation showed less variation in annual yields than that of OF, and much higher yields per Ha which suggests PC cultivation offers a more consistent and uniform client base, which is less susceptible to seasonal variation, insect problems, plant disease, and to catastrophic effects of weather conditions. As addressed in the literature review, drought has become a big concern as water shortages continue to threaten the well-being of agricultural crops. PC has the benefit of employing water conserving techniques and greater protection against uncontrollable weather events, making it potentially a more stable commodity than OF cultivation over time.

PC average farm gate value per ton was 27% higher than OF but showed higher variations. GH variation in value was most likely heavily affected by the introduction of SH use, a substitute cultivation method promising similar farm gate values per ton, but less capital investment and price variance than that of GH. SH production, on the other hand, showed 3 times less price variation than GH, yet almost equal average values per ton over a 5-year period. SH production is becoming more appealing to producers with its lower investment costs but almost equal farm gate value of GH.

Recommendations

Smaller firms such as local, regional, and national vendors, seed breeding companies, and farmer groups were found more effective in seed sales because they had a better knowledge of local conditions and lower overhead costs. Recently, larger companies able to secure local branch offices have been successful at conducting seed distribution on a regional basis, giving them the benefit of direct sales and education opportunities to provide training and technical assistance for clients, while still maintaining the benefits of a large corporation. AIS, with regional field offices located throughout Mexico, has the distinct competitive advantage of being able to offer education exchange and field knowledge as part of their services to clients, in combination with a strong market share and national infrastructure that can and should support long-term client investments.

The time and energy investments that go into building client relationships can be demanding and should be chosen strategically. Investments in the time it takes to do agricultural extension work make choosing clients with the most potential for long-term purchasing essential. Concentrating efforts on clients most likely to be lasting, such as those invested in capital investments or producers that have negotiated contracts and more steady

bases of income, will increase the likelihood that AIS investments in clients pay off. As the literature suggests, establishment of production or procurement contracts has been more common with large vegetable export entities and in PC, where some of the risk associated with higher input costs can be alleviated with the promise of a buyer at a guaranteed price. More developed seed producers can facilitate relationships between input suppliers' local field offices in Mexico and farmers, allowing for sales staff to develop close connections with vegetable producers and offer superior product education to its farmer clients in the form of field demonstrations. By providing the big picture to clients and serving as a resource, AIS can continue to build their hold in the seed distribution industry, strengthen brand recognition, and cultivate long lasting client relationships. Time and resource investments used in training producers on vegetable product genetic selection would be best served in a stable environment, where water use, and thus harvests and the need for seed, can be planned accordingly and used more efficiently to increase cultivation yields.

Sending salesmen door-to-door is extremely resource-demanding. The SAGARPA database I accessed for cultivated area, production, and farm gate value by crop should be utilized by AIS sales staff to identify and analyze geographical locations with high concentrations of key crops for other regions of Mexico. By identifying areas with high concentrations of monoculture present, AIS can tailor sales and training to the most commonly grown varieties of produce cultivated by state. Knowing where high regional concentrations of cultivation exist can enable the sales staff to use data to identify where potential clients are geographically located and can pinpoint target audiences geographically, making sales attempts more effective and efficient. High regional concentration also provides the opportunity to train several producers or cooperative owners at a time by crop specialty

Sales staff can also use the database to identify crops with high farm gate values lending themselves to higher-cost inputs such as specialty seed. Farmers engaged in forward contracts are most likely to invest in the higher capital inputs required to purchase quality seed

because of the assurance of future returns on their input investments, especially in the crops of tomatoes, chilies, bell peppers, and cucumbers which all held annual farm gate values over \$1 million in 2012. Emerging PC industries can also be researched to see if the trend is slowly occurring nationwide or if the phenomenon is strictly tied to regions that serve the US export market.

With the majority of PC and OF export farming taking place in Sinaloa, further input supplier concentration should be completed in Sinaloa with efforts concentrated on producers involved with PC and high-priced commodities cultivated for export markets. Specifically, tomatoes and chilies (green) are predominantly cultivated in Sinaloa and had the highest farm gate value out of the twelve key crops. Although just two vegetable types, sub-categories of tomatoes and hot peppers are extensive, and a good base to introduce quality specialty seed and educate on the benefits of using different varieties, especially considering their substantial concentration in the region and high farm gate values. Sinaloa is also the home to AHMPAC, who is actively promoting the expansion of PC alongside SAGARPA, and opens easy access for collaboration efforts.

The Mexican market has just recently opened itself up to the use of genetically modified seed in the form of soybeans and corn (see page 13). Opportunities to enter this market should be researched further to see if the agriculture and political realms of Mexico embrace the concepts of using genetically modified seed. Although outside the scope of this project, an analysis of the genetically modified seed companies existing in Mexico and trends in genetic seed use should be done to identify trends in this emerging seed sub-market.

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Appendix Table 1. NW Mexican Region Cultivated Area (Ha) and Value in USD (\$) Changes: 2003-2012 (Source: SAGARPA)

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BELL PEPPER												
2003	1,334		\$ 14,496,524		NPCR*		NPCR		NPCR		NPCR	
2004	1,630	22%	\$ 54,462,236	276%	NPCR		NPCR		NPCR		NPCR	
2005	4,637	248%	\$ 51,157,086	253%	NPCR		NPCR		NPCR		NPCR	
2006	6,331	375%	\$ 83,408,813	475%	NPCR		NPCR		NPCR		NPCR	
2007	5,447	308%	\$ 153,226,799	957%	NPCR		NPCR		NPCR		NPCR	
2008	5,227	292%	\$ 84,042,847	480%	NPCR		NPCR		NPCR		NPCR	
2009	3,197	140%	\$ 61,052,334	321%	43		\$ 1,205,271		353		\$ 9,636,352	
2010	3,012	126%	\$ 49,751,613	243%	177	312%	\$ 5,010,786	316%	846	140%	\$ 18,588,604	93%
2011	5,536	315%	\$ 76,235,869	426%	69	60%	\$ 1,928,588	-62%	880	149%	\$ 15,667,028	63%
2012	2,584	94%	\$ 47,983,749	231%	1,190	2667%	\$ 42,445,349	2101%	1,906	440%	\$ 98,504,732	922%
BROCCOLI												
2003	1,440		\$ 12,397,494		NPCR		NPCR		NPCR		NPCR	
2004	1,166	-19%	\$ 9,752,746	-21%	NPCR		NPCR		NPCR		NPCR	
2005	1,172	-19%	\$ 10,626,260	-14%	NPCR		NPCR		NPCR		NPCR	
2006	1,486	3%	\$ 18,503,734	49%	NPCR		NPCR		NPCR		NPCR	
2007	1,593	11%	\$ 17,913,769	44%	NPCR		NPCR		NPCR		NPCR	
2008	1,787	24%	\$ 20,241,819	63%	NPCR		NPCR		NPCR		NPCR	
2009	917	-36%	\$ 14,402,499	16%	NPCR		NPCR		NPCR		NPCR	
2010	1,155	-20%	\$ 13,247,596	7%	NPCR		NPCR		NPCR		NPCR	
2011	1,139	-21%	\$ 18,967,298	53%	NPCR		NPCR		NPCR		NPCR	
2012	1,602	11%	\$ 24,651,356	99%	NPCR		NPCR		NPCR		NPCR	
CARROT												
2003	385		\$ 1,651,785		NPCR		NPCR		NPCR		NPCR	

*NPCR – No Protected Culture Reported

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
CARROT												
2004	442	15%	\$ 1,721,424	4%	NPCR		NPCR		NPCR		NPCR	
2005	484	26%	\$ 1,806,526	9%	NPCR		NPCR		NPCR		NPCR	
2006	553	44%	\$ 2,697,632	63%	NPCR		NPCR		NPCR		NPCR	
2007	305	-21%	\$ 1,591,161	-4%	NPCR		NPCR		NPCR		NPCR	
2008	312	-19%	\$ 1,784,500	8%	NPCR		NPCR		NPCR		NPCR	
2009	417	8%	\$ 3,432,510	108%	NPCR		NPCR		NPCR		NPCR	
2010	489	27%	\$ 4,146,945	151%	NPCR		NPCR		NPCR		NPCR	
2011	604	57%	\$ 4,898,715	197%	NPCR		NPCR		NPCR		NPCR	
2012	745	94%	\$ 5,600,510	239%	NPCR		NPCR		NPCR		NPCR	
CAULIFLOWER												
2003	250		\$ 3,306,330		NPCR		NPCR		NPCR		NPCR	
2004	173	-31%	\$ 2,837,745	-14%	NPCR		NPCR		NPCR		NPCR	
2005	164	-34%	\$ 2,102,395	-36%	NPCR		NPCR		NPCR		NPCR	
2006	135	-46%	\$ 2,200,072	-33%	NPCR		NPCR		NPCR		NPCR	
2007	112	-55%	\$ 878,882	-73%	NPCR		NPCR		NPCR		NPCR	
2008	107	-57%	\$ 1,903,975	-42%	NPCR		NPCR		NPCR		NPCR	
2009	165	-34%	\$ 2,533,004	-23%	NPCR		NPCR		NPCR		NPCR	
2010	151	-40%	\$ 2,475,376	-25%	NPCR		NPCR		NPCR		NPCR	
2011	183	-27%	\$ 2,943,927	-11%	NPCR		NPCR		NPCR		NPCR	
2012	160	-36%	\$ 2,509,319	-24%	NPCR		NPCR		NPCR		NPCR	
CHILI (Green)												
2003	17,495		\$ 159,982,142		NPCR		NPCR		NPCR		NPCR	
2004	17,355	-1%	\$ 167,411,535	5%	141		\$ 11,837,036		NPCR		NPCR	
2005	14,460	-17%	\$ 138,508,465	-13%	324	130%	\$ 39,356,538	232%	NPCR		NPCR	
2006	16,773	-4%	\$ 107,365,531	-33%	155	10%	\$ 11,213,940	-5%	NPCR		NPCR	

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2007	15,620	-11%	\$ 244,985,521	53%	181	28%	\$ 3,805,828	-68%	NPCR		NPCR	
2008	14,581	-17%	\$ 233,248,383	46%	90	-36%	\$ 2,898,619	-76%	NPCR		NPCR	
2009	12,268	-30%	\$ 166,032,054	4%	183	30%	\$ 2,634,333	-78%	NPCR		NPCR	
2010	17,573	0%	\$ 240,264,246	50%	391	177%	\$ 24,256,475	105%	NPCR		NPCR	
2011	15,922	-9%	\$ 113,689,481	-29%	383	172%	\$ 24,471,683	107%	5		\$ 93,130	
2012	14,513	-17%	\$ 157,412,077	-2%	553	292%	\$ 19,202,298	62%	5	0	\$ 224,156	141%
CUCUMBER												
2003	6,756		\$ 74,407,943		19		\$ 1,934,950		NPCR		NPCR	
2004	7,688	14%	\$ 73,280,313	-2%	56	201%	\$ 7,164,729	270%	NPCR		NPCR	
2005	5,975	-12%	\$ 51,914,136	-30%	92	397%	\$ 6,203,970	221%	NPCR		NPCR	
2006	5,272	-22%	\$ 45,036,650	-39%	368	1888%	\$ 26,677,169	1279%	NPCR		NPCR	
2007	5,905	-13%	\$ 43,401,557	-42%	258	1296%	\$ 7,859,009	306%	196		\$ 7,505,264	
2008	4,987	-26%	\$ 58,803,379	-21%	157	751%	\$ 10,331,620	434%	106	-46%	\$ 4,455,570	-41%
2009	3,691	-45%	\$ 42,273,213	-43%	114	516%	\$ 9,097,420	370%	473	141%	\$ 23,536,061	214%
2010	3,415	-49%	\$ 52,934,955	-29%	364	1869%	\$ 19,199,042	892%	1,270	548%	\$ 48,179,059	542%
2011	3,359	-50%	\$ 38,108,713	-49%	326	1661%	\$ 22,215,703	1048%	869	343%	\$ 40,633,767	441%
2012	2,594	-62%	\$ 44,996,358	-40%	1,508	8052%	\$ 64,693,055	3243%	1,318	573%	\$ 42,249,394	463%
LETTUCE												
2003	1,183		\$ 8,895,560		NPCR		NPCR		NPCR		NPCR	
2004	1,297	10%	\$ 12,227,355	37%	NPCR		NPCR		NPCR		NPCR	
2005	1,282	8%	\$ 10,532,032	18%	NPCR		NPCR		NPCR		NPCR	
2006	1,235	4%	\$ 10,371,920	17%	NPCR		NPCR		NPCR		NPCR	
2007	1,216	3%	\$ 13,347,074	50%	NPCR		NPCR		NPCR		NPCR	
2008	1,368	16%	\$ 13,174,215	48%	NPCR		NPCR		NPCR		NPCR	
2009	1,889	60%	\$ 15,946,630	79%	NPCR		NPCR		NPCR		NPCR	
2010	1,808	53%	\$ 21,069,931	137%	NPCR		NPCR		NPCR		NPCR	

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
LETTUCE												
2011	2,636	123%	\$ 34,462,515	287%	NPCR		NPCR		NPCR		NPCR	
2012	1,867	58%	\$ 22,606,778	154%	0.05		\$ -					
ONION												
2003	4,568		\$ 40,129,365		NPCR		NPCR		NPCR		NPCR	
2004	5,385	18%	\$ 47,882,169	19%	NPCR		NPCR		NPCR		NPCR	
2005	4,344	-5%	\$ 33,016,833	-18%	NPCR		NPCR		NPCR		NPCR	
2006	4,658	2%	\$ 49,127,331	22%	NPCR		NPCR		NPCR		NPCR	
2007	5,339	17%	\$ 38,445,195	-4%	NPCR		NPCR		NPCR		NPCR	
2008	3,730	-18%	\$ 79,440,417	98%	NPCR		NPCR		NPCR		NPCR	
2009	4,302	-6%	\$ 62,326,424	55%	NPCR		NPCR		NPCR		NPCR	
2010	3,940	-14%	\$ 36,291,203	-10%	NPCR		NPCR		NPCR		NPCR	
2011	1,482	-68%	\$ 10,818,820	-73%	NPCR		NPCR		NPCR		NPCR	
2012	3,584	-22%	\$ 41,282,272	3%	NPCR		NPCR		NPCR		NPCR	
ONION (Green)												
2003	7,687		\$ 32,189,638		NPCR		NPCR		NPCR		NPCR	
2004	7,435	-3%	\$ 20,323,305	-37%	NPCR		NPCR		NPCR		NPCR	
2005	6,163	-20%	\$ 60,070,895	87%	NPCR		NPCR		NPCR		NPCR	
2006	1,754	-77%	\$ 23,290,701	-28%	NPCR		NPCR		NPCR		NPCR	
2007	10,055	31%	\$ 23,850,266	-26%	NPCR		NPCR		NPCR		NPCR	
2008	5,442	-29%	\$ 15,671,719	-51%	NPCR		NPCR		NPCR		NPCR	
2009	5,461	-29%	\$ 71,062,086	121%	NPCR		NPCR		NPCR		NPCR	
2010	5,676	-26%	\$ 86,207,807	168%	1.2		\$ 41,839		NPCR		NPCR	
2011	5,542	-28%	\$ 77,526,035	141%	1	-17%	\$ 31,136	-26%	NPCR		NPCR	
2012	6,077	-21%	\$ 90,489,138	181%	0.2	-83%	\$ 10,703	-74%	NPCR		NPCR	

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
SPINACH												
2003	256		\$ 1,023,478		NPCR		NPCR		NPCR		NPCR	
2004	169	-34%	\$ 627,191	-39%	NPCR		NPCR		NPCR		NPCR	
2005	271	6%	\$ 998,609	-2%	NPCR		NPCR		NPCR		NPCR	
2006	252	-2%	\$ 893,798	-13%	NPCR		NPCR		NPCR		NPCR	
2007	152	-41%	\$ 348,653	-66%	NPCR		NPCR		NPCR		NPCR	
2008	137	-46%	\$ 586,880	-43%	NPCR		NPCR		NPCR		NPCR	
2009	84	-67%	\$ 540,074	-47%	NPCR		NPCR		NPCR		NPCR	
2010	262	2%	\$ 3,118,278	205%	NPCR		NPCR		NPCR		NPCR	
2011	195	-24%	\$ 2,102,421	105%	NPCR		NPCR		NPCR		NPCR	
2012	185	-28%	\$ 2,531,947	147%	NPCR		NPCR		NPCR		NPCR	
SQUASH												
2003	14,669		\$ 82,777,569		NPCR		NPCR		NPCR		NPCR	
2004	12,698	-13%	\$ 90,099,392	9%	NPCR		NPCR		NPCR		NPCR	
2005	12,951	-12%	\$ 67,754,389	-18%	NPCR		NPCR		NPCR		NPCR	
2006	14,473	-1%	\$ 75,644,660	-9%	NPCR		NPCR		NPCR		NPCR	
2007	13,950	-5%	\$ 72,564,230	-12%	NPCR		NPCR		NPCR		NPCR	
2008	10,262	-30%	\$ 74,853,939	-10%	3		\$ 50,040		NPCR		NPCR	
2009	10,746	-27%	\$ 93,199,804	13%	0.75	-75%	\$ 14,727	-71%	NPCR		NPCR	
2010	10,852	-26%	\$ 79,613,157	-4%	19	533%	\$ 338,929	577%	NPCR		NPCR	
2011	11,699	-20%	\$ 52,788,180	-36%	19.4	547%	\$ 359,654	619%	5		\$ 101,934	
2012	9,956	-32%	\$ 94,968,585	15%	3	0%	\$ 192,275	284%	5	0%	\$ 189,615	186%
TOMATO												
2003	32,805		\$ 418,581,671		71		\$ 14,192,087		NPCR		NPCR	
2004	38,531	17%	\$ 869,652,867	108%	129	82%	\$ 13,471,198	-5%	NPCR		NPCR	
2005	37,324	14%	\$ 517,319,856	24%	83	17%	\$ 5,824,527	-59%	NPCR		NPCR	

NW Crop Cultivation by Year	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
TOMATO												
2006	32,435	-1%	\$ 603,683,615	44%	388	446%	\$ 38,387,924	170%	NPCR		NPCR	
2007	28,156	-14%	\$ 478,229,515	14%	489	589%	\$ 29,173,492	106%	NPCR		NPCR	
2008	22,945	-30%	\$ 565,939,028	35%	253	256%	\$ 28,738,081	102%	9,882		\$ 471,462,662	
2009	20,262	-38%	\$ 442,194,843	6%	291	310%	\$ 21,597,102	52%	1,438		\$ 60,818,481	
2010	19,148	-42%	\$ 435,740,254	4%	605	752%	\$ 47,766,838	237%	1,932	34%	\$ 153,880,036	153%
2011	16,465	-50%	\$ 136,485,071	-67%	1,960	2661%	\$ 51,242,606	261%	3,728	159%	\$ 134,145,154	121%
2012	15,808	-52%	\$ 207,344,456	-50%	6,664	9285%	\$ 190,925,833	1245%	2,911	94%	\$ 122,618,991	102%

Appendix Table 2. Cultivated Area (Ha) and Value (\$) Changes by State: 2003-2012 (SAGARPA)

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BELL PEPPER												
2003	48		\$ 243,158		NPCR		NPCR		NPCR		NPCR	
2004	67	40%	\$ 618,371	154%	NPCR		NPCR		NPCR		NPCR	
2005	66	38%	\$ 602,403	148%	NPCR		NPCR		NPCR		NPCR	
2006	7	-85%	\$ 55,137	-77%	NPCR		NPCR		NPCR		NPCR	
2007	21	-56%	\$ 87,570	-64%	NPCR		NPCR		NPCR		NPCR	
2008	47	-2%	\$ 354,451	46%	NPCR		NPCR		NPCR		NPCR	
2009	10	-79%	\$ 41,700	-83%	NPCR		NPCR		NPCR		NPCR	
2010	21	-56%	\$ 130,290	-46%	NPCR		NPCR		NPCR		NPCR	
2011	13	-73%	\$ 49,580	-80%	NPCR		NPCR		NPCR		NPCR	
2012	29	-40%	\$ 166,754	-31%	NPCR		NPCR		NPCR		NPCR	
BROCCOLI												
2003	532		\$ 3,095,227.6		NPCR		NPCR		NPCR		NPCR	
2004	554	4%	\$ 3,267,567.5	6%	NPCR		NPCR		NPCR		NPCR	
2005	633	19%	\$ 3,601,917.0	16%	NPCR		NPCR		NPCR		NPCR	
2006	572	8%	\$ 4,860,171.6	57%	NPCR		NPCR		NPCR		NPCR	
2007	817	54%	\$ 6,641,346.1	115%	NPCR		NPCR		NPCR		NPCR	
2008	686	29%	\$ 5,543,537.7	79%	NPCR		NPCR		NPCR		NPCR	
2009	320	-40%	\$ 2,999,979.0	-3%	NPCR		NPCR		NPCR		NPCR	
2010	217	-59%	\$ 2,637,773.0	-15%	NPCR		NPCR		NPCR		NPCR	
2011	385	-28%	\$ 8,274,743.9	167%	NPCR		NPCR		NPCR		NPCR	
2012	589	11%	\$ 9,852,437.8	218%	NPCR		NPCR		NPCR		NPCR	
CARROT												
2003	114		\$ 674,316.3		NPCR		NPCR		NPCR		NPCR	
2004	109	-4%	\$ 700,142.5	4%	NPCR		NPCR		NPCR		NPCR	

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
CARROT												
2005	80	-30%	\$ 449,197.9	-33%	NPCR		NPCR		NPCR		NPCR	
2006	167	46%	\$ 1,302,782.9	93%	NPCR		NPCR		NPCR		NPCR	
2007	184	61%	\$ 904,050.4	34%	NPCR		NPCR		NPCR		NPCR	
2008	102	-11%	\$ 979,722.1	45%	NPCR		NPCR		NPCR		NPCR	
2009	114	0%	\$ 1,184,895.8	76%	NPCR		NPCR		NPCR		NPCR	
2010	68	-40%	\$ 729,688.4	8%	NPCR		NPCR		NPCR		NPCR	
2011	216	89%	\$ 2,354,481.2	249%	NPCR		NPCR		NPCR		NPCR	
2012	285	150%	\$ 2,690,524.6	299%	NPCR		NPCR		NPCR		NPCR	
CAULIFLOWER												
2003	61		\$ 407,913.9		NPCR		NPCR		NPCR		NPCR	
2004	36	-41%	\$ 218,548.3	-46%	NPCR		NPCR		NPCR		NPCR	
2005	44	-28%	\$ 238,419.8	-42%	NPCR		NPCR		NPCR		NPCR	
2006	44	-28%	\$ 277,292.6	-32%	NPCR		NPCR		NPCR		NPCR	
2007	92	51%	\$ 545,281.4	34%	NPCR		NPCR		NPCR		NPCR	
2008	39	-36%	\$ 404,731.7	-1%	NPCR		NPCR		NPCR		NPCR	
2009	73	20%	\$ 745,521.5	83%	NPCR		NPCR		NPCR		NPCR	
2010	67	10%	\$ 1,024,784.2	151%	NPCR		NPCR		NPCR		NPCR	
2011	78	27%	\$ 1,650,535.6	305%	NPCR		NPCR		NPCR		NPCR	
2012	104	70%	\$ 1,970,265.0	383%	NPCR		NPCR		NPCR		NPCR	
CHILI (Green)												
2003	696		\$ 5,820,801		NPCR		NPCR		NPCR		NPCR	
2004	813	17%	\$ 10,898,365	87%	NPCR		NPCR		NPCR		NPCR	
2005	673	-3%	\$ 5,916,442	2%	NPCR		NPCR		NPCR		NPCR	
2006	704	1%	\$ 6,547,291	12%	NPCR		NPCR		NPCR		NPCR	
2007	411	-41%	\$ 3,359,751	-42%	NPCR		NPCR		NPCR		NPCR	

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
CHILI (Green)												
2008	785	13%	\$ 8,822,044	52%	1		\$ 14,641		NPCR		NPCR	
2009	752	8%	\$ 9,560,678	64%	0.2	-80%	\$ 10,703	-27%	NPCR		NPCR	
2010	707	2%	\$ 9,875,273	70%	NPCR		NPCR		NPCR		NPCR	
2011	722	4%	\$ 8,936,567	54%	NPCR		NPCR		NPCR		NPCR	
2012	550	-21%	\$ 7,854,907	35%	NPCR		NPCR		NPCR		NPCR	
CUCUMBER												
2003	1,517		\$ 25,355,938		7	NPCR	\$ 875,582		NPCR		NPCR	
2004	1,152	-24%	\$ 22,282,520	-12%	56	758%	\$ 7,164,729	718%	NPCR		NPCR	
2005	869	-43%	\$ 15,222,550	-40%	80	1131%	\$ 5,814,769	564%	NPCR		NPCR	
2006	910	-40%	\$ 16,512,972	-35%	63	874%	\$ 4,803,157	449%	NPCR		NPCR	
2007	609	-60%	\$ 9,069,034	-64%	165	2432%	\$ 5,703,578	551%	196		\$ 7,505,264	
2008	548	-64%	\$ 13,676,845	-46%	74	1044%	\$ 5,323,156	508%	106	-46%	\$ 4,455,570	-41%
2009	311	-79%	\$ 6,736,707	-73%	82	1160%	\$ 6,414,134	633%	318	62%	\$ 17,698,516	136%
2010	278	-82%	\$ 6,891,228	-73%	111	1611%	\$ 7,460,392	752%	405	107%	\$ 31,629,009	321%
2011	161	-89%	\$ 3,258,684	-87%	65	905%	\$ 5,019,381	473%	451	130%	\$ 29,937,787	299%
2012	149	-90%	\$ 4,060,686	-84%	78	1096%	\$ 3,918,339	348%	479	144%	\$ 16,380,226	118%
LETTUCE												
2003	474		\$ 5,753,327		NPCR		NPCR		NPCR		NPCR	
2004	803	69%	\$ 8,008,469	39%	NPCR		NPCR		NPCR		NPCR	
2005	514	8%	\$ 2,987,351	-48%	NPCR		NPCR		NPCR		NPCR	
2006	463	-2%	\$ 4,923,943	-14%	NPCR		NPCR		NPCR		NPCR	
2007	442	-7%	\$ 4,417,196	-23%	NPCR		NPCR		NPCR		NPCR	
2008	707	49%	\$ 7,914,853	38%	NPCR		NPCR		NPCR		NPCR	
2009	1,334	181%	\$ 10,710,478	86%	NPCR		NPCR		NPCR		NPCR	
2010	1,282	170%	\$ 16,928,173	194%	NPCR		NPCR		NPCR		NPCR	

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
LETTUCE												
2011	2,099	343%	\$ 30,485,683	430%	NPCR		NPCR		NPCR		NPCR	
2012	1,422	200%	\$ 19,377,777	237%	NPCR		NPCR		NPCR		NPCR	
ONION												
2003	2,241				NPCR		NPCR		NPCR		NPCR	
2004	2,708	21%	\$ 27,054,923		NPCR		NPCR		NPCR		NPCR	
2005	2,808	25%	\$ 37,628,171	39%	NPCR		NPCR		NPCR		NPCR	
2006	2,737	22%	\$ 24,701,268	-9%	NPCR		NPCR		NPCR		NPCR	
2007	3,700	65%	\$ 35,284,644	30%	NPCR		NPCR		NPCR		NPCR	
2008	2,132	-5%	\$ 24,918,567	-8%	NPCR		NPCR		NPCR		NPCR	
2009	2,840	27%	\$ 67,280,343	149%	NPCR		NPCR		NPCR		NPCR	
2010	2,772	24%	\$ 49,614,103	83%	NPCR		NPCR		NPCR		NPCR	
2011	1,911	-15%	\$ 27,007,864	0%	NPCR		NPCR		NPCR		NPCR	
2012	3,584	60%	\$ 26,447,048	-2%	NPCR		NPCR		NPCR		NPCR	
ONION (Green)												
2003	5,455		\$ 49,750,979		NPCR		NPCR		NPCR		NPCR	
2004	5,551		\$ 46,221,762		NPCR		NPCR		NPCR		NPCR	
2005	4,308		\$ 37,782,405		NPCR		NPCR		NPCR		NPCR	
2006	4,420		\$ 29,538,578		NPCR		NPCR		NPCR		NPCR	
2007	4,040		\$ 35,831,491		NPCR		NPCR		NPCR		NPCR	
2008	4,263		\$ 30,093,282		NPCR		NPCR		NPCR		NPCR	
2009	4,133		\$ 55,332,815		NPCR		NPCR		NPCR		NPCR	
2010	4,207		\$ 61,890,681		NPCR		NPCR		NPCR		NPCR	
2011	4,179		\$ 58,281,910		NPCR		NPCR		NPCR		NPCR	
2012	4,870		\$ 73,205,797		NPCR		NPCR		NPCR		NPCR	

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
SPINACH												
2003	160		\$ 579,390		NPCR		NPCR		NPCR		NPCR	
2004	125	-22%	\$ 420,592	-27%	NPCR		NPCR		NPCR		NPCR	
2005	181	13%	\$ 698,368	21%	NPCR		NPCR		NPCR		NPCR	
2006	189	18%	\$ 684,630	18%	NPCR		NPCR		NPCR		NPCR	
2007	93	-42%	\$ 154,053	-73%	NPCR		NPCR		NPCR		NPCR	
2008	115	-28%	\$ 499,147	-14%	NPCR		NPCR		NPCR		NPCR	
2009	72	-55%	\$ 499,763	-14%	NPCR		NPCR		NPCR		NPCR	
2010	231	44%	\$ 3,005,053	419%	NPCR		NPCR		NPCR		NPCR	
2011	167	4%	\$ 1,936,547	234%	NPCR		NPCR		NPCR		NPCR	
2012	155	-3%	\$ 2,265,344	291%	NPCR		NPCR		NPCR		NPCR	
SQUASH												
2003	772		\$ 5,369,912		NPCR		NPCR		NPCR		NPCR	
2004	660	-14%	\$ 6,750,465	26%	NPCR		NPCR		NPCR		NPCR	
2005	810	5%	\$ 4,178,043	-22%	NPCR		NPCR		NPCR		NPCR	
2006	598	-22%	\$ 4,548,086	-15%	NPCR		NPCR		NPCR		NPCR	
2007	820	6%	\$ 5,413,015	1%	NPCR		NPCR		NPCR		NPCR	
2008	823	7%	\$ 6,222,611	16%	3		\$ 50,040		NPCR		NPCR	
2009	885	15%	\$ 6,840,280	27%	0.75	-75%	\$ 14,727	-71%	NPCR		NPCR	
2010	848	10%	\$ 4,498,920	-16%		-100%		-100%	NPCR		NPCR	
2011	642	-17%	\$ 3,562,720	-34%	19	533%	\$ 338,929	577%	NPCR		NPCR	
2012	616	-20%	\$ 4,930,698	-8%	16.4	447%	\$ 284,302	468%	NPCR		NPCR	
TOMATO												
2003	5,601		\$ 143,439,469		43		\$ 2,887,357		NPCR		NPCR	
2004	6,191	11%	\$ 396,416,091	176%	21	-50%	\$ 4,666,603	62%	NPCR		NPCR	
2005	5,655	1%	\$ 142,873,903	0%	53	25%	\$ 3,155,721	9%	NPCR		NPCR	

Baja Norte 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
TOMATO												
2006	4,908	-12%	\$ 181,801,783	27%	19	-55%	\$ 3,144,145	9%	NPCR		NPCR	
2007	3,154	-44%	\$ 95,225,836	-34%	217	411%	\$ 10,958,734	280%	NPCR		NPCR	
2008	3,510	-37%	\$ 92,934,293	-35%	125	194%	\$ 8,114,295	181%	NPCR		NPCR	
2009	2,262	-60%	\$ 106,671,372	-26%	53	25%	\$ 4,964,060	72%	916		\$ 45,210,289	
2010	2,629	-53%	\$ 137,899,476	-4%	147	245%	\$ 10,495,536	263%	776	-15%	\$ 85,925,052	90%
2011	1,636	-71%	\$ 21,578,960	-85%	110	160%	\$ 3,397,676	18%	1,029	12%	\$ 64,091,583	42%
2012	1,708	-69%	\$ 57,188,947	-60%	223	425%	\$ 11,068,306	283%	1,021	11%	\$ 68,509,097	52%
Baja Sur 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BELL PEPPER												
2003					NPCR		NPCR		NPCR		NPCR	
2004	163		\$ 618,371		NPCR		NPCR		NPCR		NPCR	
2005	66	-60%	\$ 602,403	-3%	NPCR		NPCR		NPCR		NPCR	
2006	91	-44%	\$ 5,485,596	787%	NPCR		NPCR		NPCR		NPCR	
2007	129	-21%	\$ 5,153,773	733%	NPCR		NPCR		NPCR		NPCR	
2008	78	-52%	\$ 1,508,153	144%	NPCR		NPCR		NPCR		NPCR	
2009	510	213%	\$ 11,389,600	1742%	NPCR		NPCR		NPCR		NPCR	
2010	161	-1%	\$ 10,741,941	1637%	NPCR		NPCR		NPCR		NPCR	
2011	35	-79%	\$ 1,541,236	149%	NPCR		NPCR		NPCR		NPCR	
2012					62		\$ 3,852,254		178		\$ 9,320,431	
BROCCOLI												
2003	1		\$ 3,336.0		NPCR		NPCR		NPCR		NPCR	
2004	1	33%	\$ 7,413.3	122%	NPCR		NPCR		NPCR		NPCR	
2005	1	-33%	\$ 4,633.3	39%	NPCR		NPCR		NPCR		NPCR	

Baja Sur 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BROCCOLI												
2006	1	67%	\$ 5,374.7	61%	NPCR		NPCR		NPCR		NPCR	
2007	2	100%	\$ 9,045.2	171%	NPCR		NPCR		NPCR		NPCR	
2008	1	67%	\$ 1,042.5	-69%	NPCR		NPCR		NPCR		NPCR	
2009	1	67%	\$ 4,862.2	46%	NPCR		NPCR		NPCR		NPCR	
2010	2	167%	\$ 10,842.0	225%	NPCR		NPCR		NPCR		NPCR	
2011	2	167%	\$ 11,238.6	237%	NPCR		NPCR		NPCR		NPCR	
2012	5	500%	\$ 38,010.1	1039%	NPCR		NPCR		NPCR		NPCR	
CARROT												
2003	6		\$ 23,027.7		NPCR		NPCR		NPCR		NPCR	
2004	10	67%	\$ 29,885.1	30%	NPCR		NPCR		NPCR		NPCR	
2005	8	33%	\$ 30,580.1	33%	NPCR		NPCR		NPCR		NPCR	
2006	11	75%	\$ 46,741.2	103%	NPCR		NPCR		NPCR		NPCR	
2007	7	21%	\$ 78,354.5	240%	NPCR		NPCR		NPCR		NPCR	
2008	6	-8%	\$ 60,696.8	164%	NPCR		NPCR		NPCR		NPCR	
2009	27	346%	\$ 83,491.0	263%	NPCR		NPCR		NPCR		NPCR	
2010	25	317%	\$ 90,127.8	291%	NPCR		NPCR		NPCR		NPCR	
2011	15	150%	\$ 55,352.7	140%	NPCR		NPCR		NPCR		NPCR	
2012	7	8%	\$ 25,744.7	12%	NPCR		NPCR		NPCR		NPCR	
CAULIFLOWER												
2008	1		\$ 1,042.5		NPCR		NPCR		NPCR		NPCR	
2009	1	0	\$ 2,085.0	100%	NPCR		NPCR		NPCR		NPCR	
CHILI (Green)												
2003	2,193		\$ 25,074,003						NPCR		NPCR	
2004	1,956	-11%	\$ 28,845,557	15%	141		\$ 11,837,036		NPCR		NPCR	
2005	2,008	-8%	\$ 30,521,451	22%	324	130%	\$ 39,356,538	232%	NPCR		NPCR	

Baja Sur 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2006	1,941	-11%	\$ 14,704,756	-41%	120	-15%	\$ 9,267,936	-22%	NPCR		NPCR	
2007	1,336	-39%	\$ 23,972,395	-4%	43	-70%	\$ 3,347,127	-72%	NPCR		NPCR	
2008	1,541	-30%	\$ 28,202,900	12%	28	-80%	\$ 1,453,016	-88%	NPCR		NPCR	
2009	827	-62%	\$ 9,514,197	-62%	-	-100%		-100%	NPCR		NPCR	
2010	1,177	-46%	\$ 22,343,637	-11%	36	-74%	\$ 3,202,566	-73%	NPCR		NPCR	
2011	1,360	-38%	\$ 19,581,023	-22%	181	28%	\$ 16,117,225	36%	NPCR		NPCR	
2012	1,309	-40%	\$ 25,575,033	2%					NPCR		NPCR	
CUCUMBER												
2003	122		\$ 1,729,340		12		\$ 1,059,367		NPCR		NPCR	
2004	145	18%	\$ 1,659,890	-4%	-				NPCR		NPCR	
2005	144	18%	\$ 2,051,525	19%	12	0%	\$ 389,201	-63%	NPCR		NPCR	
2006	36	-71%	\$ 167,249	-90%	88	633%	\$ 3,113,571	194%	NPCR		NPCR	
2007	107	-12%	\$ 529,569	-69%	66	448%	\$ 1,827,390	72%	NPCR		NPCR	
2008	102	-17%	\$ 2,361,131	37%	50	313%	\$ 2,275,070	115%	NPCR		NPCR	
2009	60	-51%	\$ 505,127	-71%	4	-67%	\$ 159,226	-85%	155		\$ 5,837,545	
2010	86	-30%	\$ 642,077	-63%	12	0%	\$ 457,311	-57%	56	-64%	\$ 2,697,070	-54%
2011	37	-70%	\$ 267,661	-85%	-				150	-3%	\$ 4,238,240	-27%
2012	41	-67%	\$ 369,491	-79%	-				81	-48%	\$ 3,563,398	-39%
LETTUCE												
2003	11		\$ 9,915		NPCR		NPCR		NPCR		NPCR	
2004	5	-56%	\$ 13,298	34%	NPCR		NPCR		NPCR		NPCR	
2005	11	-4%	\$ 42,071	324%	NPCR		NPCR		NPCR		NPCR	
2006	8	-33%	\$ 29,839	201%	NPCR		NPCR		NPCR		NPCR	
2007	10	-9%	\$ 51,986	424%	NPCR		NPCR		NPCR		NPCR	
2008	8	-33%	\$ 32,433	227%	NPCR		NPCR		NPCR		NPCR	
2009	8	-33%	\$ 46,345	367%	NPCR		NPCR		NPCR		NPCR	

Baja Sur 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2010	14	24%	\$ 109,046	1000%	NPCR		NPCR		NPCR		NPCR	
2011	17	51%	\$ 98,956	898%	NPCR		NPCR		NPCR		NPCR	
2012	11	-4%	\$ 48,832	392%	NPCR		NPCR		NPCR		NPCR	
ONION												
2003	162		\$ 1,068,747		NPCR		NPCR		NPCR		NPCR	
2004	128	-21%	\$ 390,528		NPCR		NPCR		NPCR		NPCR	
2005	82	-49%	\$ 478,837	-63%	NPCR		NPCR		NPCR		NPCR	
2006	68	-58%	\$ 312,261	-55%	NPCR		NPCR		NPCR		NPCR	
2007	51	-68%	\$ 794,463	-71%	NPCR		NPCR		NPCR		NPCR	
2008	166	3%	\$ 2,221,045	-26%	NPCR		NPCR		NPCR		NPCR	
2009	95	-41%	\$ 791,033	108%	NPCR		NPCR		NPCR		NPCR	
2010	101	-37%	\$ 1,085,940	-26%	NPCR		NPCR		NPCR		NPCR	
2011	194	20%	\$ 1,955,363	2%	NPCR		NPCR		NPCR		NPCR	
2012	69	-57%	\$ 698,248	-35%	NPCR		NPCR		NPCR		NPCR	
ONION (Green) - NO PRODUCTION												
SPINACH - NO PRODUCTION												
SQUASH												
2003	289		\$ 1,258,359		NPCR		NPCR		NPCR		NPCR	
2004	234	-19%	\$ 1,445,567	15%	NPCR		NPCR		NPCR		NPCR	
2005	176	-39%	\$ 1,236,877	-2%	NPCR		NPCR		NPCR		NPCR	
2006	248	-14%	\$ 1,720,753	37%	NPCR		NPCR		NPCR		NPCR	
2007	205	-29%	\$ 1,388,573	10%	NPCR		NPCR		NPCR		NPCR	
2008	231	-20%	\$ 1,102,746	-12%	NPCR		NPCR		NPCR		NPCR	
2009	199	-31%	\$ 1,214,242	-4%	NPCR		NPCR		NPCR		NPCR	
2010	217	-25%	\$ 1,226,866	-3%	NPCR		NPCR		NPCR		NPCR	
2011	235	-19%	\$ 2,891,169	130%	NPCR		NPCR		NPCR		NPCR	

Baja Sur 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2012	274	-5%	\$ 2,701,866	115%	NPCR		NPCR		NPCR		NPCR	
TOMATO												
2003	2,847		\$ 69,492,499		NPCR		NPCR		NPCR		NPCR	
2004	3,509	23%	\$ 72,252,267	4%	108		\$ 8,804,595		NPCR		NPCR	
2005	3,373	18%	\$ 75,456,872	9%	30	-72%	\$ 2,668,805	-70%	NPCR		NPCR	
2006	3,271	15%	\$ 111,472,541	60%	129	19%	\$ 13,165,438	50%	NPCR		NPCR	
2007	3,214	13%	\$ 67,959,715	-2%	244	126%	\$ 10,623,490	21%	NPCR		NPCR	
2008	2,476	-13%	\$ 76,067,828	9%	93	-14%	\$ 10,716,773	22%	NPCR		NPCR	
2009	2,516	-12%	\$ 58,526,686	-16%	43	-60%	\$ 3,030,345	-66%	NPCR		NPCR	
2010	2,149	-25%	\$ 61,451,263	-12%	158	46%	\$ 6,835,107	-22%	NPCR		NPCR	
2011	1,857	-35%	\$ 48,702,727	-30%	89	-18%	\$ 4,558,746	-48%	353		\$ 18,023,147.5	-16%
2012	1,739	-39%	\$ 49,178,440	-29%	35	-68%	\$ 2,396,087	-73%	459	30%	\$ 15,217,686.4	-100%
Sinaloa 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BELL PEPPER												
2003	1,286		\$ 14,253,366		NPCR		NPCR		NPCR		NPCR	
2004	1,400	9%	\$ 46,024,465	223%	NPCR		NPCR		NPCR		NPCR	
2005	4,571	255%	\$ 50,554,683	255%	NPCR		NPCR		NPCR		NPCR	
2006	5,745	347%	\$ 74,129,679	420%	NPCR		NPCR		NPCR		NPCR	
2007	5,092	296%	\$ 147,194,292	933%	NPCR		NPCR		NPCR		NPCR	
2008	4,705	266%	\$ 77,172,480	441%	NPCR		NPCR		NPCR		NPCR	
2009	2,660	107%	\$ 49,377,783	246%	43		\$ 1,205,271		353		\$ 9,636,352	
2010	2,830	120%	\$ 38,879,382	173%	177	312%	\$ 5,010,786	316%	846	140%	\$ 18,588,604	93%
2011	5,150	300%	\$ 68,907,122	383%	69	60%	\$ 1,928,588	60%	880	149%	\$ 15,667,028	63%
2012	2,425	89%	\$ 45,414,329	219%	1,128	2523%	\$ 38,593,095	3102%	1,728	390%	\$ 89,184,301	825%
BROCCOLI												
2003	82		159572.3177		NPCR		NPCR		NPCR		NPCR	
CARROT - NO PRODUCTION												

Sinaloa 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
CAULIFLOWER - NO PRODUCTION												
CHILI (Green)												
2003	11,956		\$ 107,974,409.6		NPCR		NPCR		NPCR		NPCR	
2004	11,777	-1%	\$ 107,241,521.3	-1%	NPCR		NPCR		NPCR		NPCR	
2005	11,779	-1%	\$ 102,070,572.0	-5%	NPCR		NPCR		NPCR		NPCR	
2006	11,436	-4%	\$ 61,724,680.7	-43%	NPCR		NPCR		NPCR		NPCR	
2007	12,217	2%	\$ 207,203,011.6	92%	NPCR		NPCR		NPCR		NPCR	
2008	10,419	-13%	\$ 178,256,627.5	65%	NPCR		NPCR		NPCR		NPCR	
2009	8,721	-27%	\$ 124,570,340.2	15%	NPCR		NPCR		NPCR		NPCR	
2010	13,338	12%	\$ 180,373,625.8	67%	NPCR		NPCR		NPCR		NPCR	
2011	10,427	-13%	\$ 64,922,330.1	-40%	NPCR		NPCR		NPCR		NPCR	
2012	9,930	-17%	\$ 102,199,991.5	-5%	NPCR		NPCR		NPCR		NPCR	
CUCUMBER												
2003	4,860		\$ 46,794,001		NPCR		NPCR		NPCR		NPCR	
2004	5,875	21%	\$ 47,993,084	3%	NPCR		NPCR		NPCR		NPCR	
2005	4,560	-6%	\$ 32,506,021	-31%	NPCR		NPCR		NPCR		NPCR	
2006	3,959	-19%	\$ 26,792,878	-43%	NPCR		NPCR		NPCR		NPCR	
2007	4,554	-6%	\$ 29,766,124	-36%	NPCR		NPCR		NPCR		NPCR	
2008	3,687	-24%	\$ 37,783,324	-19%	NPCR		NPCR		NPCR		NPCR	
2009	2,792	-43%	\$ 31,884,693	-32%	NPCR		NPCR		NPCR		NPCR	
2010	2,525	-48%	\$ 41,307,852	-12%	91		\$ 1,910,846		809		\$ 13,852,981	
2011	2,789	-43%	\$ 31,092,839	-34%	87	-4%	\$ 2,435,883	27%	191	-76%	\$ 3,022,021	-78%
2012	2,022	-58%	\$ 37,637,465	-20%	1,186	1203%	\$ 42,024,901	2099%	633.55	-22%	\$ 15,880,365	15%
LETTUCE												
2006	12		\$ 8,896		NPCR		NPCR		NPCR		NPCR	
2009	10	-17%	\$ 55,600	525%	NPCR		NPCR		NPCR		NPCR	
ONION												
2003	1,172		\$ 6,323,086		NPCR		NPCR		NPCR		NPCR	
2004	1,859	59%	\$ 6,146,514	-3%	NPCR		NPCR		NPCR		NPCR	
2005	864	-26%	\$ 3,138,483	-49%	NPCR		NPCR		NPCR		NPCR	
2006	859	-27%	\$ 4,239,481	-31%	NPCR		NPCR		NPCR		NPCR	
2007	826	-30%	\$ 5,532,934	-10%	NPCR		NPCR		NPCR		NPCR	
2008	706	-40%	\$ 3,904,506	-36%	NPCR		NPCR		NPCR		NPCR	

Sinaloa 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2009	662	-44%	\$ 5,416,883	-12%	NPCR		NPCR		NPCR		NPCR	
2010	283	-76%	\$ 889,809	-86%	NPCR		NPCR		NPCR		NPCR	
2011	647	-45%	\$ 3,814,620	-38%	NPCR		NPCR		NPCR		NPCR	
2012	966	-18%	\$ 8,024,541	31%	NPCR		NPCR		NPCR		NPCR	
ONION (Green)												
2006	5		\$ 11,120		NPCR		NPCR		NPCR		NPCR	
SPINACH - NO PRODUCTION												
2003	160		\$ 579,390		NPCR		NPCR		NPCR		NPCR	
2004	125	-22%	\$ 420,592	-27%	NPCR		NPCR		NPCR		NPCR	
2005	181	13%	\$ 698,368	21%	NPCR		NPCR		NPCR		NPCR	
2006	189	18%	\$ 684,630	18%	NPCR		NPCR		NPCR		NPCR	
2007	93	-42%	\$ 154,053	-73%	NPCR		NPCR		NPCR		NPCR	
2008	115	-28%	\$ 499,147	-14%	NPCR		NPCR		NPCR		NPCR	
2009	72	-55%	\$ 499,763	-14%	NPCR		NPCR		NPCR		NPCR	
2010	231	44%	\$ 3,005,053	419%	NPCR		NPCR		NPCR		NPCR	
2011	167	4%	\$ 1,936,547	234%	NPCR		NPCR		NPCR		NPCR	
2012	155	-3%	\$ 2,265,344	291%	NPCR		NPCR		NPCR		NPCR	
SQUASH												
2003	9183.75		\$ 53,606,679		NPCR		NPCR		NPCR		NPCR	
2004	8293.2	-10%	\$ 61,375,387	14%	NPCR		NPCR		NPCR		NPCR	
2005	8228.5	-10%	\$ 43,877,703	-18%	NPCR		NPCR		NPCR		NPCR	
2006	9214	0%	\$ 43,197,946	-19%	NPCR		NPCR		NPCR		NPCR	
2007	8304.1	-10%	\$ 38,067,163	-29%	NPCR		NPCR		NPCR		NPCR	
2008	4773.5	-48%	\$ 35,269,093	-34%	NPCR		NPCR		NPCR		NPCR	
2009	4630.55	-50%	\$ 44,196,531	-18%	NPCR		NPCR		NPCR		NPCR	
2010	4751.15	-48%	\$ 28,054,778	-48%	NPCR		NPCR		NPCR		NPCR	
2011	5217.9	-43%	\$ 13,465,987	-75%	NPCR		NPCR		NPCR		NPCR	
2012	3896.39	-58%	\$ 37,073,210	-31%	NPCR		NPCR		NPCR		NPCR	
TOMATO												
2003	21,911		\$ 186,073,995		NPCR		NPCR		NPCR		NPCR	
2004	26,405	21%	\$ 382,368,119	105%	NPCR		NPCR		NPCR		NPCR	
2005	26,300	20%	\$ 272,426,358	46%	NPCR		NPCR		NPCR		NPCR	
2006	22,137	1%	\$ 275,486,713	48%	NPCR		NPCR		NPCR		NPCR	

Sinaloa 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2007	19,548	-11%	\$ 289,847,158	56%	NPCR		NPCR		NPCR		NPCR	
2008	15,784	-28%	\$ 379,899,076	104%	NPCR		NPCR		NPCR		NPCR	
2009	14,254	-35%	\$ 260,238,898	40%	131		\$ 7,372,241		522		\$ 15,608,192	
2010	12,700	-42%	\$ 210,125,974	13%	240	83%	\$ 22,040,579	199%	1156	121%	\$ 67,954,984	335%
2011	11,704	-47%	\$ 55,795,501	-70%	1,527	1066%	\$ 27,800,596	277%	2168.14	315%	\$ 46,731,905	199%
2012	11,216	-49%	\$ 90,315,787	-51%	6,102	4558%	\$ 155,319,380	2007%	1305.5	150%	\$ 38,892,208	149%
Sonora 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
BELL PEPPER												
2006	488		\$ 3,738,401		NPCR		NPCR		NPCR		NPCR	
2007	206	-58%	\$ 791,165	-79%	NPCR		NPCR		NPCR		NPCR	
2008	397	-19%	\$ 5,007,763	34%	NPCR		NPCR		NPCR		NPCR	
2009	17	-97%	\$ 243,250	-93%	NPCR		NPCR		NPCR		NPCR	
2010	-				NPCR		NPCR		NPCR		NPCR	
2011	338	-31%	\$ 5,737,931	53%	NPCR		NPCR		NPCR		NPCR	
2012	130	-73%	\$ 2,402,666	-36%	NPCR		NPCR		NPCR		NPCR	
BROCCOLI												
2003	825		\$ 9,139,358		NPCR		NPCR		NPCR		NPCR	
2004	611	-26%	\$ 6,477,765	-29%	NPCR		NPCR		NPCR		NPCR	
2005	538	-35%	\$ 7,019,710	-23%	NPCR		NPCR		NPCR		NPCR	
2006	913	11%	\$ 13,638,188	49%	NPCR		NPCR		NPCR		NPCR	
2007	774	-6%	\$ 11,263,378	23%	NPCR		NPCR		NPCR		NPCR	
2008	1,100	33%	\$ 14,697,239	61%	NPCR		NPCR		NPCR		NPCR	
2009	596	-28%	\$ 11,397,658	25%	NPCR		NPCR		NPCR		NPCR	
2010	936	13%	\$ 10,598,981	16%	NPCR		NPCR		NPCR		NPCR	
2011	752	-9%	\$ 10,681,315	17%	NPCR		NPCR		NPCR		NPCR	
2012	1,008	22%	\$ 14,760,908	62%	NPCR		NPCR		NPCR		NPCR	
CARROT												
2003	265		\$ 954,440.8		NPCR		NPCR		NPCR		NPCR	
2004	323	22%	\$ 991,396.3	4%	NPCR		NPCR		NPCR		NPCR	
2005	396	49%	\$ 1,326,748.4	39%	NPCR		NPCR		NPCR		NPCR	

Sonora 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2006	375	42%	\$ 1,348,108.1	41%	NPCR		NPCR		NPCR		NPCR	
2007	114	-57%	\$ 608,756.3	-36%	NPCR		NPCR		NPCR		NPCR	
2008	204	-23%	\$ 744,081.5	-22%	NPCR		NPCR		NPCR		NPCR	
2009	276	4%	\$ 2,164,123.1	127%	NPCR		NPCR		NPCR		NPCR	
2010	396	49%	\$ 3,327,129.2	249%	NPCR		NPCR		NPCR		NPCR	
2011	373	41%	\$ 2,488,881.5	161%	NPCR		NPCR		NPCR		NPCR	
2012	454	71%	\$ 2,884,240.9	202%	NPCR		NPCR		NPCR		NPCR	
CAULIFLOWER												
2003	189		\$ 2,898,416.2		NPCR		NPCR		NPCR		NPCR	
CAULIFLOWER												
2004	137	-28%	\$ 2,619,197.0	-10%	NPCR		NPCR		NPCR		NPCR	
2005	120	-37%	\$ 1,863,975.2	-36%	NPCR		NPCR		NPCR		NPCR	
2006	91	-52%	\$ 1,922,779.7	-34%	NPCR		NPCR		NPCR		NPCR	
2007	20	-89%	\$ 333,600.7	-88%	NPCR		NPCR		NPCR		NPCR	
2008	67	-65%	\$ 1,498,200.6	-48%	NPCR		NPCR		NPCR		NPCR	
2009	91	-52%	\$ 1,785,397.4	-38%	NPCR		NPCR		NPCR		NPCR	
2010	84	-56%	\$ 1,450,592.1	-50%	NPCR		NPCR		NPCR		NPCR	
2011	105	-44%	\$ 1,293,391.1	-55%	NPCR		NPCR		NPCR		NPCR	
2012	56	-71%	\$ 539,054.2	-81%	NPCR		NPCR		NPCR		NPCR	
CHILI (Green)												
2003	2651		\$ 21,112,929		NPCR		NPCR		NPCR		NPCR	
2004	2808	6%	\$ 20,426,092	-3%	NPCR		NPCR		NPCR		NPCR	
2005	2694	2%	\$ 21,298,178	1%	NPCR		NPCR		NPCR		NPCR	
2006	2692.5	2%	\$ 24,388,803	16%	35		\$ 1,946,003.87		NPCR		NPCR	
2007	1656.5	-38%	\$ 10,450,364	-51%	138	294%	\$ 458,700.91	-76%	NPCR		NPCR	
2008	1836	-31%	\$ 17,966,812	-15%	60	71%	\$ 1,334,402.66	-31%	NPCR		NPCR	
2009	1968.18	-26%	\$ 22,386,838	6%	182	420%	\$ 2,597,266.51	33%	NPCR		NPCR	
2010	2352	-11%	\$ 27,671,711	31%	355	914%	\$ 21,053,908.59	982%	NPCR		NPCR	
2011	3413.5	29%	\$ 20,249,561	-4%	202	477%	\$ 8,354,457.81	329%	5		\$ 93,130.19	
2012	2725	3%	\$ 21,782,146	3%	553	1480%	\$ 19,202,297.95	887%	5	0	\$ 224,156.48	141%
CUCUMBER												
2003	257		\$ 528,664		NPCR		NPCR		NPCR		NPCR	
2004	516	101%	\$ 1,344,818	154%	NPCR		NPCR		NPCR		NPCR	

Sonora 2003-2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2005	403	57%	\$ 2,134,040	304%	NPCR		NPCR		NPCR		NPCR	
2006	368	43%	\$ 1,563,551	196%	217		\$ 18,760,441		NPCR		NPCR	
2007	635	147%	\$ 4,036,829	664%	28	-87%	\$ 328,041	-98%	NPCR		NPCR	
2008	651	153%	\$ 4,982,079	842%	34	-85%	\$ 2,733,394	-85%	NPCR		NPCR	
2009	529	106%	\$ 3,146,685	495%	28	-87%	\$ 2,524,060	-87%	NPCR		NPCR	
2010	526	105%	\$ 4,093,798	674%	151	-30%	\$ 9,370,492	-50%	NPCR		NPCR	
2011	373	45%	\$ 3,489,530	560%	174	-20%	\$ 14,760,439	-21%	77		\$ 3,435,720	
2012	383	49%	\$ 2,928,715	454%	245	13%	\$ 18,749,815	0%	124.5	62%	\$ 6,425,405	87%
LETTUCE												
2003	698		\$ 3,132,317		NPCR		NPCR		NPCR		NPCR	
2004	489	-30%	\$ 4,205,588	34%	NPCR		NPCR		NPCR		NPCR	
2005	757	8%	\$ 7,502,609	140%	NPCR		NPCR		NPCR		NPCR	
2006	753	8%	\$ 5,409,242	73%	NPCR		NPCR		NPCR		NPCR	
2007	764	9%	\$ 8,877,892	183%	NPCR		NPCR		NPCR		NPCR	
2008	653	-6%	\$ 5,226,929	67%	NPCR		NPCR		NPCR		NPCR	
2009	537	-23%	\$ 5,134,207	64%	NPCR		NPCR		NPCR		NPCR	
2010	513	-27%	\$ 4,032,712	29%	NPCR		NPCR		NPCR		NPCR	
2011	520	-25%	\$ 3,877,875	24%	NPCR		NPCR		NPCR		NPCR	
2012	434	-38%	\$ 3,180,170	2%	NPCR		NPCR		NPCR		NPCR	
ONION												
2003	2,241				NPCR		NPCR		NPCR		NPCR	
2004	2,708	21%	\$ 27,054,923		NPCR		NPCR		NPCR		NPCR	
2005	2,808	25%	\$ 37,628,171	39%	NPCR		NPCR		NPCR		NPCR	
2006	2,737	22%	\$ 24,701,268	-9%	NPCR		NPCR		NPCR		NPCR	
2007	3,700	65%	\$ 35,284,644	30%	NPCR		NPCR		NPCR		NPCR	
2008	2,132	-5%	\$ 24,918,567	-8%	NPCR		NPCR		NPCR		NPCR	
2009	2,840	27%	\$ 67,280,343	149%	NPCR		NPCR		NPCR		NPCR	
2010	2,772	24%	\$ 49,614,103	83%	NPCR		NPCR		NPCR		NPCR	
2011	1,911	-15%	\$ 27,007,864	0%	NPCR		NPCR		NPCR		NPCR	
2012	3,584	60%	\$ 26,447,048	-2%	NPCR		NPCR		NPCR		NPCR	
ONION (Green)												
2003	2,232		\$ 31,567,936		NPCR		NPCR		NPCR		NPCR	
2004	1,884	-16%	\$ 19,666,945	-38%	NPCR		NPCR		NPCR		NPCR	

Sonora 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2005	1,855	-17%	\$ 22,288,491	-29%	NPCR		NPCR		NPCR		NPCR	
2006	1,749	-22%	\$ 23,279,581	-26%	NPCR		NPCR		NPCR		NPCR	
2007	1,595	-29%	\$ 22,562,382	-29%	NPCR		NPCR		NPCR		NPCR	
2008	1,179	-47%	\$ 14,162,083	-55%	NPCR		NPCR		NPCR		NPCR	
2009	1,328	-40%	\$ 15,729,271	-50%	NPCR		NPCR		NPCR		NPCR	
2010	1,469	-34%	\$ 24,317,125	-23%	NPCR		NPCR		NPCR		NPCR	
2011	1,363	-39%	\$ 19,244,125	-39%	NPCR		NPCR		NPCR		NPCR	
2012	1,207	-46%	\$ 17,283,342	-45%	NPCR		NPCR		NPCR		NPCR	
SPINACH												
2003	96		\$ 444,088		NPCR		NPCR		NPCR		NPCR	
2004	44	-54%	\$ 206,599	-53%	NPCR		NPCR		NPCR		NPCR	
2005	90	-6%	\$ 300,241	-32%	NPCR		NPCR		NPCR		NPCR	
2006	63	-34%	\$ 209,168	-53%	NPCR		NPCR		NPCR		NPCR	
2007	59	-39%	\$ 194,600	-56%	NPCR		NPCR		NPCR		NPCR	
2008	22	-77%	\$ 87,732	-80%	NPCR		NPCR		NPCR		NPCR	
2009	12	-88%	\$ 40,310	-91%	NPCR		NPCR		NPCR		NPCR	
2010	31	-68%	\$ 113,225	-75%	NPCR		NPCR		NPCR		NPCR	
2011	28	-71%	\$ 165,874	-63%	NPCR		NPCR		NPCR		NPCR	
2012	30	-69%	\$ 266,603	-40%	NPCR		NPCR		NPCR		NPCR	
SQUASH												
2003	4,425		\$ 22,542,618		NPCR		NPCR		NPCR		NPCR	
2004	3,511	-21%	\$ 20,527,973	-9%	NPCR		NPCR		NPCR		NPCR	
2005	3,737	-16%	\$ 18,461,766	-18%	NPCR		NPCR		NPCR		NPCR	
2006	4,414	0%	\$ 26,177,875	16%	NPCR		NPCR		NPCR		NPCR	
2007	4,622	4%	\$ 27,695,479	23%	NPCR		NPCR		NPCR		NPCR	
2008	4,435	0%	\$ 32,259,488	43%	NPCR		NPCR		NPCR		NPCR	
2009	5,032	14%	\$ 40,948,751	82%	NPCR		NPCR		NPCR		NPCR	
2010	5,037	14%	\$ 45,832,593	103%	NPCR		NPCR		NPCR		NPCR	
2011	5,604	27%	\$ 32,868,304	46%	3		\$ 75,352		5		\$ 101,934	
2012	5,170	17%	\$ 50,262,811	123%	3	0%	\$ 192,275	155%	5	0%	\$ 189,615	86%
TOMATO												
2003	2447		\$ 19,575,708		29		\$ 11,304,729		NPCR		NPCR	
2004	2426	-1%	\$ 18,616,390	-5%	NPCR	-100%	NPCR	-100%	NPCR		NPCR	

Sonora 2003- 2012	Open Field Cultivated Area (Ha)	% Change Cultivated Area	Open Field Value (\$)	% Change Value	Greenhouse Cultivated Area (Ha)	% Change Cultivated Area	Greenhouse Value (\$)	% Change Value	Shade house Cultivated Area (Ha)	% Change Cultivated Area	Shade house Value (\$)	% Change Value
2005	1996	-18%	\$ 26,562,723	36%	NPCR	-100%	NPCR	-100%	NPCR		NPCR	
2006	2119	-13%	\$ 34,922,578	78%	240	742%	\$ 22,078,341	95%	NPCR		NPCR	
2007	2241	-8%	\$ 25,196,806	29%	28	-2%	\$ 7,591,268	-33%	NPCR		NPCR	
2008	1175	-52%	\$ 17,037,831	-13%	35	23%	\$ 9,907,013	-12%	NPCR		NPCR	
2009	1230	-50%	\$ 16,757,886	-14%	64	123%	\$ 6,230,456	-45%	NPCR		NPCR	
2010	1671	-32%	\$ 26,263,540	34%	61	114%	\$ 8,395,617	-26%	NPCR		NPCR	
2011	1268	-48%	\$ 10,407,884	-47%	234	720%	\$ 15,485,588	37%	178		\$ 5,298,518	
2012	1145	-53%	\$ 10,661,283	-46%	304	966%	\$ 22,142,060	96%	127	-29%	\$ 3,597,030	-32%

Appendix Table 3. NW Mexico Cultivated Area Forecasts: 2013-2017 (Source: SAGARPA)

NW Mexico Cultivated Area Forecast: 2013-2017			
	OPEN FIELD	GREENHOUSE	SHADE HOUSE
BELL PEPPER			
Best-fit line	$Y = 126.35x + 3198.5$	$Y = 178.78x$	$Y = 410.28x$
R^2	0.21	0.81	0.98
p-value	0.547	0.137	0.013
2003	1334	NPCR	NPCR
2004	1630	NPCR	NPCR
2005	4637	NPCR	NPCR
2006	6331	NPCR	NPCR
2007	5447	NPCR	NPCR
2008	5227	NPCR	NPCR
2009	3197	43	353
2010	3012	177	846
2011	5536	69	880
2012	2584	1190	1906
2013	4588	1203	2170
2014	4184	1709	2700
2015	3479	2276	3345
2016	3125	2536	3741
2017	3157	3073	4329
BROCCOLI			
Best-fit line	$Y = -1.98x + 1356.5$		
R^2	0.02		
p-value	0.952		
2003	1440	NPCR	NPCR
2004	1166	NPCR	NPCR
2005	1172	NPCR	NPCR
2006	1486	NPCR	NPCR
2007	1593	NPCR	NPCR
2008	1787	NPCR	NPCR
2009	917	NPCR	NPCR
2010	1155	NPCR	NPCR
2011	1139	NPCR	NPCR
2012	1602	NPCR	NPCR
2013	1335	NPCR	NPCR
2014	1355	NPCR	NPCR
2015	1319	NPCR	NPCR
2016	1256	NPCR	NPCR
2017	1242	NPCR	NPCR
CARROT			
Best-fit line	$Y = 24.24x + 340.12$		
R^2	0.54		
p-value	0.10		
2003	385	NPCR	NPCR
2004	442	NPCR	NPCR
2005	484	NPCR	NPCR
2006	553	NPCR	NPCR
2007	305	NPCR	NPCR
2008	312	NPCR	NPCR

NW Mexico Cultivated Area Forecast: 2013-2017			
	OPEN FIELD	GREENHOUSE	SHADE HOUSE
2009	417	NPCR	NPCR
2010	489	NPCR	NPCR
2011	604	NPCR	NPCR
2012	745	NPCR	NPCR
2013	607	NPCR	NPCR
2014	637	NPCR	NPCR
2015	679	NPCR	NPCR
2016	736	NPCR	NPCR
2017	821	NPCR	NPCR
CAULIFLOWER			
Best-fit line	$Y = -4.41x + 184.15$		
R ²	0.33		
p-value	0.35		
2003	250	NPCR	NPCR
2004	173	NPCR	NPCR
2005	164	NPCR	NPCR
2006	135	NPCR	NPCR
2007	112	NPCR	NPCR
2008	107	NPCR	NPCR
2009	165	NPCR	NPCR
2010	151	NPCR	NPCR
2011	183	NPCR	NPCR
2012	160	NPCR	NPCR
2013	136	NPCR	NPCR
2014	150	NPCR	NPCR
2015	157	NPCR	NPCR
2016	166	NPCR	NPCR
2017	172	NPCR	NPCR
CHILI (Green)			
Best-fit line	$Y = -298.94x + 17569.57$	$Y = 45.02x$	
R ²	0.52	0.80	
p-value	0.11	0.004	
2003	17495	NPCR	NPCR
2004	17355	141	NPCR
2005	17154	324	NPCR
2006	16773	155	NPCR
2007	15620	181	NPCR
2008	14581	90	NPCR
2009	12268	183	NPCR
2010	17573	391	NPCR
2011	15922	383	NPCR
2012	14513	553	NPCR
2013	14281	458	NPCR
2014	14042	505	NPCR
2015	13884	602	NPCR
2016	13830	675	NPCR
2017	13872	752	NPCR
CUCUMBER			
Best-fit line	$Y = -522.49x + 7837.96$	$Y = 67.11x$	$Y = 210.53x$

NW Mexico Cultivated Area Forecast: 2013-2017			
	OPEN FIELD	GREENHOUSE	SHADE HOUSE
R ²	0.95	0.79	0.96
p-value	0.001	0.005	0.002
2003	6756	19	NPCR
2004	7688	56	NPCR
2005	5975	92	NPCR
2006	5272	368	NPCR
2007	5905	258	196
2008	4987	157	106
2009	3691	114	473
2010	3415	364	1270
2011	3359	326	869
2012	2594	1508	1318
2013	2091	853	1575
2014	1419	981	1883
2015	1038	1115	2073
2016	466	1251	2229
2017	0	1447	2595
LETTUCE			
Best-fit line	Y = 122.87x + 902.18		
R ²	0.80		
p-value	0.005		
2003	1183	NPCR	NPCR
2004	1297	NPCR	NPCR
2005	1282	NPCR	NPCR
2006	1235	NPCR	NPCR
2007	1216	NPCR	NPCR
2008	1368	NPCR	NPCR
2009	1889	NPCR	NPCR
2010	1808	NPCR	NPCR
2011	2636	NPCR	NPCR
2012	1867	NPCR	NPCR
2013	2254	NPCR	NPCR
2014	2419	NPCR	NPCR
2015	2609	NPCR	NPCR
2016	2796	NPCR	NPCR
2017	2957	NPCR	NPCR
ONION			
Best-fit line	Y = -239.46x + 5469.58		
R ²	0.68		
p-value	0.02		
2003	4568	NPCR	NPCR
2004	5385	NPCR	NPCR
2005	4344	NPCR	NPCR
2006	4658	NPCR	NPCR
2007	5339	NPCR	NPCR
2008	3730	NPCR	NPCR
2009	4302	NPCR	NPCR
2010	3940	NPCR	NPCR
2011	1676	NPCR	NPCR

NW Mexico Cultivated Area Forecast: 2013-2017			
	OPEN FIELD	GREENHOUSE	SHADE HOUSE
2012	3584	NPCR	NPCR
2013	2836	NPCR	NPCR
2014	2419	NPCR	NPCR
2015	2170	NPCR	NPCR
2016	1742	NPCR	NPCR
2017	1370	NPCR	NPCR
ONION (Green)			
Best-fit line	$Y = -199.89x + 7228.57$		
R ²	0.73		
p-value	0.017		
2003	7687	NPCR	NPCR
2004	7435	NPCR	NPCR
2005	6163	NPCR	NPCR
2006	6414	NPCR	NPCR
2007	5395	NPCR	NPCR
2008	5442	NPCR	NPCR
2009	5461	NPCR	NPCR
2010	5676	NPCR	NPCR
2011	5542	NPCR	NPCR
2012	6077	NPCR	NPCR
2013	5030	NPCR	NPCR
2014	5005	NPCR	NPCR
2015	5081	NPCR	NPCR
2016	5010	NPCR	NPCR
2017	5049	NPCR	NPCR
SPINACH			
Best-fit line	$Y = -6.17x + 230.16$		
R ²	0.09		
p-value	0.405		
2003	256	NPCR	NPCR
2004	169	NPCR	NPCR
2005	271	NPCR	NPCR
2006	252	NPCR	NPCR
2007	152	NPCR	NPCR
2008	137	NPCR	NPCR
2009	84	NPCR	NPCR
2010	262	NPCR	NPCR
2011	195	NPCR	NPCR
2012	185	NPCR	NPCR
2013	162	NPCR	NPCR
2014	165	NPCR	NPCR
2015	151	NPCR	NPCR
2016	159	NPCR	NPCR
2017	174	NPCR	NPCR
SQUASH			
Best-fit line	$Y = -453.19 + 14718.17$		
R ²	0.60		
p-value	0.008		
2003	14669	NPCR	NPCR

NW Mexico Cultivated Area Forecast: 2013-2017			
	OPEN FIELD	GREENHOUSE	SHADE HOUSE
2004	12698	NPCR	NPCR
2005	12951	NPCR	NPCR
2006	14473	NPCR	NPCR
2007	13950	NPCR	NPCR
2008	10262	NPCR	NPCR
2009	10746	NPCR	NPCR
2010	10852	NPCR	NPCR
2011	11699	NPCR	NPCR
2012	9956	NPCR	NPCR
2013	9733	NPCR	NPCR
2014	9388	NPCR	NPCR
2015	8708	NPCR	NPCR
2016	8043	NPCR	NPCR
2017	7803	NPCR	NPCR
TOMATO			
Best-fit line	$Y = -2666.92 + 41056$	$Y = 249x$	$Y = 937.68x$
R^2	0.88	0.50	0.967
p-value	0.001	0.017	0.022
2003	32805	71	NPCR
2004	38531	129	NPCR
2005	37324	83	NPCR
2006	32435	388	NPCR
2007	28156	489	NPCR
2008	22945	253	NPCR
2009	20262	291	1438
2010	19148	605	1932
2011	16465	1960	3728
2012	15808	6537	2912
2013	11720	3517	4057
2014	7564	4222	4546
2015	4678	4996	4711
2016	2380	5793	5528
2017	37	6663	5856

Appendix Table 4. Cultivated Area and Production by State: 2003-2012 (SAGARPA)

State	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Baja California Norte									
BELL PEPPER									
2003	48	537	\$ 243,158	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	67	1,256	\$ 618,371	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	66	1,254	\$ 602,403	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	7	119	\$ 55,137	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	21	189	\$ 87,570	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	47	765	\$ 354,451	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	10	90	\$ 41,700	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	21	142	\$ 130,290	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2011	12.8	119	\$ 49,580	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2012	29	436	\$ 166,754	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
CHILI (Green)									
2003	695.5	14,361	\$ 5,820,801	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	813	16,855	\$ 10,898,365	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	673	12,017	\$ 5,916,442	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	703.5	13,162	\$ 6,547,291	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	411	8,048	\$ 3,359,751	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	785	15,671	\$ 8,822,044	2	60	\$ 111,200	NPCR	NPCR	NPCR
2009	752	21,164	\$ 9,560,678	1	25	\$ 37,067	NPCR	NPCR	NPCR
2010	706.5	21,061	\$ 9,875,273	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2011	721.5	19,904	\$ 8,936,567	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2012	550	14,273	\$ 7,854,907	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
CUCUMBER									
2003	1517	47,713	\$ 25,355,938	7	833.05	\$ 875,582	NPCR	NPCR	NPCR
2004	1152	33,772	\$ 22,282,520	56	6522.26	\$ 7,164,729	NPCR	NPCR	NPCR

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Baja California Norte									
CUCUMBER									
2005	869	21,351	\$ 15,222,550	80	6535.75	\$ 5,814,769	NPCR	NPCR	NPCR
2006	910	29,030	\$ 16,512,972	63	6063.67	\$ 4,803,157	NPCR	NPCR	NPCR
2007	609	19,685	\$ 9,069,034	165	8894.86	\$ 5,703,578	196	12308.8	\$ 7,505,264
2008	548	19,372	\$ 13,676,845	74	5680.51	\$ 5,323,156	106	6678	\$ 4,455,570
2009	311	8,945	\$ 6,736,707	82	6117.91	\$ 6,414,134	318	22260	\$ 17,698,516
2010	278	8,171	\$ 6,891,228	111	8311.43	\$ 7,460,392	404.9	28498.68	\$ 31,629,009
2011	161	4,427	\$ 3,258,684	65	5279.39	\$ 5,019,381	450.79	27856.4	\$ 29,937,787
2012	149	5,505	\$ 4,060,686	78	5573.3	\$ 3,918,339	479.1	32784.66	\$ 16,380,226
TOMATO									
2003	5600.7	245,911	\$ 143,439,469	43	5145.25	\$ 2,887,357	NPCR	NPCR	NPCR
2004	6191	290,735	\$ 396,416,091	21	3341.41	\$ 4,666,603	NPCR	NPCR	NPCR
2005	5655	255,763	\$ 142,873,903	53	6695	\$ 3,155,721	NPCR	NPCR	NPCR
2006	4908	212,750	\$ 181,801,783	19	3249.6	\$ 3,144,145	NPCR	NPCR	NPCR
2007	3153.5	172,970	\$ 95,225,836	217	23417.88	\$ 10,958,734	NPCR	NPCR	NPCR
2008	3510.45	192,393	\$ 92,934,293	125	13864.58	\$ 8,114,295	NPCR	NPCR	NPCR
2009	2262	101,775	\$ 106,671,372	53	6187.16	\$ 4,964,060	915.5	72173	\$ 45,210,289
2010	2628.5	140,508	\$ 137,899,476	147	14929.55	\$ 10,495,536	775.8	66188.67	\$ 85,925,052
2011	1636.18	67,977	\$ 21,578,960	110	9983	\$ 3,397,676	1028.66	84364.53	\$ 64,091,583
2012	1708.25	82,101	\$ 57,188,947	223	21297.14	\$ 11,068,306	1020.5	86238.06	\$ 68,509,097
Baja California Sur									
BELL PEPPER									
2003	0	0	0	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	163	10,548	\$ 7,819,399	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	0	0	0	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	91	4,320	\$ 5,485,596	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Baja California Sur									
BELL PEPPER									
2007	128.5	7,335	\$ 5,153,773	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	77.5	5,425	\$ 1,508,153	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	510	14,730	\$ 11,389,600	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	161	9,660	\$ 10,741,941	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2011	35	1,470	\$ 1,541,236	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2012	0	0	0	62	4650	\$ 3,852,254	178	12460	\$ 9,320,431
CHILI (Green)									
2003	2193.3	57,669	\$ 25,074,003	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	1956.25	48,524	\$ 28,845,557	141	9124.11	\$ 11,837,036	NPCR	NPCR	NPCR
2005	2007.5	55,766	\$ 30,521,451	324	32670	\$ 39,356,538	NPCR	NPCR	NPCR
2006	1941.25	37,178	\$ 14,704,756	120	7925	\$ 9,267,936	NPCR	NPCR	NPCR
2007	1335.75	36,557	\$ 23,972,395	43	3010	\$ 3,347,127	NPCR	NPCR	NPCR
2008	1541.25	43,104	\$ 28,202,900	28	1960	\$ 1,453,016	NPCR	NPCR	NPCR
2009	827	18,396	\$ 9,514,197	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	1176.5	31,154	\$ 22,343,637	36	2880	\$ 3,202,566	NPCR	NPCR	NPCR
2011	1360	32,492	\$ 19,581,023	181	14.481.81	\$ 16,117,225	NPCR	NPCR	NPCR
2012	1308.75	39,090	\$ 25,575,033	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
CUCUMBER									
2003	122	4,203	\$ 1,729,340	12	2072.2	\$ 1,059,367	NPCR	NPCR	NPCR
2004	144.5	4,011	\$ 1,659,890	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	143.5	4,957	\$ 2,051,525	12	420	\$ 389,201	NPCR	NPCR	NPCR
2006	35.5	429	\$ 167,249	88	4667.23	\$ 3,113,571	NPCR	NPCR	NPCR
2007	107	1,639	\$ 529,569	66	3200	\$ 1,827,390	NPCR	NPCR	NPCR
2008	101.5	4,860	\$ 2,361,131	50	3959.88	\$ 2,275,070	NPCR	NPCR	NPCR
2009	59.5	1,751	\$ 505,127	4	66.81	\$ 159,226	154.5	14030	\$ 5,837,545

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Baja California Sur									
CUCUMBER									
2010	85.75	1,300	\$ 642,077	12	735	\$ 457,311	56	4621	\$ 2,697,070
2011	36.5	650	\$ 267,661	NPCR	NPCR	NPCR	150	9960	\$ 4,238,240
2012	40.5	960	\$ 369,491	NPCR	NPCR	NPCR	81	6875	\$ 3,563,398
TOMATO									
2003	2847	122,045	\$ 69,492,499	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	3508.75	104,570	\$ 72,252,267	108	8879.76	\$ 8,804,595	NPCR	NPCR	NPCR
2005	3373.3	115,554	\$ 75,456,872	30	2400	\$ 2,668,805	NPCR	NPCR	NPCR
2006	3270.7	103,732	\$ 111,472,541	129	10730	\$ 13,165,438	NPCR	NPCR	NPCR
2007	3213.5	118,493	\$ 67,959,715	244	14380	\$ 10,623,490	NPCR	NPCR	NPCR
2008	2476	103,767	\$ 76,067,828	93	8260.6	\$ 10,716,773	NPCR	NPCR	NPCR
2009	2516.08	98,737	\$ 58,526,686	43	3870	\$ 3,030,345	NPCR	NPCR	NPCR
2010	2148.5	94,012	\$ 61,451,263	158	9200	\$ 6,835,107	NPCR	NPCR	NPCR
2011	1857	61,525	\$ 48,702,727	89	7385	\$ 4,558,746	353	23972.91	\$ 18,023,147
2012	1738.74	76,489	\$ 49,178,440	35	4080	\$ 2,396,087	459	26290	\$ 15,217,686
Sinaloa									
BELL PEPPER									
2003	1286	51,271	\$ 14,253,366	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	1400	53,069	\$ 46,024,465	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	4570.5	207,585	\$ 50,554,683	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	5745	266,657	\$ 74,129,679	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	5092	265,326	\$ 147,194,292	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	4705.05	233,057	\$ 77,172,480	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	2660	131,422	\$ 49,377,783	43	2673	\$ 1,205,271	353	21263	\$ 9,636,352
2010	2830	146,296	\$ 38,879,382	177	12705	\$ 5,010,786	846	63558	\$ 18,588,604
2011	5149.92	127,061	\$ 68,907,122	69	3647.51	\$ 1,928,588	879.5	29622.52	\$ 15,667,028

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Sinaloa									
BELL PEPPER									
2012	2425.43	104,455	\$ 45,414,329	1,128	87144.08	\$ 38,593,095	1728.26	144498.46	\$ 89,184,301
CHILI (Green)									
2003	11955.5	278,291	\$ 107,974,410	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	11777.4	266,772	\$ 107,241,521	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	11779	262,218	\$ 102,070,572	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	11435.81	221,496	\$ 61,724,681	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	12217.02	429,308	\$ 207,203,012	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	10418.85	378,433	\$ 178,256,627	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	8720.74	229,894	\$ 124,570,340	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	13338.02	395,551	\$ 180,373,626	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2011	10426.52	141,195	\$ 64,922,330	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2012	9929.65	220,365	\$ 102,199,991	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
CUCUMBER									
2003	4860	189,798	\$ 46,794,001	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	5875	226,968	\$ 47,993,084	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	4559.5	204,850	\$ 32,506,021	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	3959	184,281	\$ 26,792,878	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	4554	212,895	\$ 29,766,124	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	3687	195,278	\$ 37,783,324	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	2791.68	166,897	\$ 31,884,693	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	2525.33	122,054	\$ 41,307,852	91	8008	\$ 1,910,846	809	58534	\$ 13,852,981
2011	2788.98	68,565	\$ 31,092,839	87	7683.55	\$ 2,435,883	191	10047.81	\$ 3,022,021
2012	2022.36	109,468	\$ 37,637,465	1,186	122785.5	\$ 42,024,901	633.55	51075.5	\$ 15,880,365
TOMATO									
2003	21911	742,685	\$ 186,073,995	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Sinaloa									
TOMATO									
2004	26405	991,113	\$ 382,368,119	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	26299.5	845,477	\$ 272,426,358	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	22137	783,314	\$ 275,486,713	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	19548.25	827,011	\$ 289,847,158	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	15783.98	782,910	\$ 379,899,076	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	14254.13	602,691	\$ 260,238,898	131	16236	\$ 7,372,241	522	49376	\$ 15,608,192
2010	12699.68	527,049	\$ 210,125,974	240	37200	\$ 22,040,579	1156	122808	\$ 67,954,984
2011	11704.04	143,307	\$ 55,795,501	1,527	93107.37	\$ 27,800,596	2168.14	108596.49	\$ 46,731,905
2012	11216.05	346,097	\$ 90,315,787	6,102	584402.5	\$ 155,319,380	1305.5	108868.25	\$ 38,892,208
Sonora									
BELL PEPPER									
2003	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	488	9,556	\$ 3,738,401	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	205.9	2,388	\$ 791,165	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	397	8,617	\$ 5,007,763	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	17	375	\$ 243,250	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2010	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2011	338	7,740	\$ 5,737,931	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2012	130	4,560	\$ 2,402,666	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
CHILI (Green)									
2003	2651	45,879	\$ 21,112,929	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	2808	35,902	\$ 20,426,092	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	2694	41,206	\$ 21,298,178	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Sonora									
CHILI (Green)									
2006	2692.5	47,957	\$ 24,388,803	35	3500	\$ 1,946,004	NPCR	NPCR	NPCR
2007	1656.5	21,662	\$ 10,450,364	138	1740	\$ 458,701	NPCR	NPCR	NPCR
2008	1836	30,868	\$ 17,966,812	60	4800	\$ 1,334,403	NPCR	NPCR	NPCR
2009	1968.18	42,007	\$ 22,386,838	182	4004	\$ 2,597,267	NPCR	NPCR	NPCR
2010	2352	50,820	\$ 27,671,711	355	28400	\$ 21,053,909	NPCR	NPCR	NPCR
2011	3413.5	59,885	\$ 20,249,561	202	15977.98	\$ 8,354,458	5	335	\$ 93,130
2012	2725	48,666	\$ 21,782,146	553	29875.76	\$ 19,202,298	5	343.6	\$ 224,156
CUCUMBER									
2003	257	3,840	\$ 528,664	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	516	9,189	\$ 1,344,818	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	403	7,670	\$ 2,134,040	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	367.5	6,335	\$ 1,563,551	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	635	12,784	\$ 4,036,829	28	1680	\$ 328,041	NPCR	NPCR	NPCR
2008	650.5	13,867	\$ 4,982,079	34	4132	\$ 2,733,394	NPCR	NPCR	NPCR
2009	529	9,550	\$ 3,146,685	28	3506	\$ 2,524,060	NPCR	NPCR	NPCR
2010	526	10,193	\$ 4,093,798	151	12071.58	\$ 9,370,492	NPCR	NPCR	NPCR
2011	373	8,114	\$ 3,489,530	174	19695	\$ 14,760,439	77	5850	\$ 3,435,720
2012	382.5	6,834	\$ 2,928,715	245	42760.6	\$ 18,749,815	124.5	15551.79	\$ 6,425,405
TOMATO									
2003	2446.5	57,325	\$ 19,575,708	29	11052	\$ 11,304,729	NPCR	NPCR	NPCR
2004	2426	51,339	\$ 18,616,390	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	1996	47,412	\$ 26,562,723	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	2119	53,266	\$ 34,922,578	240	19830	\$ 22,078,341	NPCR	NPCR	NPCR
2007	2241	53,869	\$ 25,196,806	28	9740	\$ 7,591,268	NPCR	NPCR	NPCR
2008	1175	33,294	\$ 17,037,831	35	10700	\$ 9,907,013	NPCR	NPCR	NPCR

	OPEN FIELD			GREENHOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)	Cultivated Area (Ha)	Production (Tons)	Value (\$)
Sonora									
2009	1229.88	34,373	\$ 16,757,886	64	7027.5	\$ 6,230,456	NPCR	NPCR	NPCR
2010	1671	48,221	\$ 26,263,540	61	11910	\$ 8,395,617	NPCR	NPCR	NPCR
2011	1268	20,819	\$ 10,407,884	234	26914.86	\$ 15,485,588	178	12984.38	\$ 5,298,518
2012	1145	32,032	\$ 10,661,283	177	40323.98	\$ 18,545,031	126.5	9967.64	\$ 3,597,030

Appendix Table 5. Cultivation, Production, and Value by State:2003-2012 (SAGARPA)

	OPEN FIELD			GREEN HOUSE			SHADE HOUSE		
State	Cultivated Area (Ha)	Production (Tons)	Value in \$	Cultivated Area (Ha)	Production (Tons)	Value in \$	Cultivated Area (Ha)	Production (Tons)	Value in \$
BJ NORTE									
2003	17,669	522,263	\$ 267,545,355	49	5,978	\$ 3,762,940	NPCR	NPCR	NPCR
2004	18,768	579,118	\$ 533,431,065	77	9,864	\$ 11,831,332	NPCR	NPCR	NPCR
2005	16,641	506,790	\$ 239,252,269	133	13,231	\$ 8,970,490	NPCR	NPCR	NPCR
2006	15,958	459,373	\$ 286,337,312	82	9,313	\$ 7,947,303	NPCR	NPCR	NPCR
2007	14,142	439,987	\$ 186,567,192	385	32,433	\$ 16,712,352	196	12,309	\$ 7,505,264
2008	13,757	426,497	\$ 234,725,861	203	19,616	\$ 13,578,019	106	6,678	\$ 4,455,570
2009	13,106	384,609	\$ 250,938,292	136	12,334	\$ 11,425,965	1,234	94,433	\$ 62,908,805
2010	13,324	412,958	\$ 272,519,204	277	23,906	\$ 18,294,857	1,181	94,687	\$ 117,554,061
2011	10,296	214,476	\$ 140,370,412	192	16,106	\$ 8,701,359	1,479	112,221	\$ 94,029,370
2012	12,388	326,495	\$ 210,011,185	301	26,870	\$ 14,986,645	1,500	119,023	\$ 84,889,323
BJ SUR									
2003	5,631	191,748	\$ 98,659,227	12	2,072	\$ 1,059,367	NPCR	NPCR	NPCR
2004	6,150	172,879	\$ 112,463,804	249	18,004	\$ 20,641,631	NPCR	NPCR	NPCR
2005	5,801	181,408	\$ 109,822,846	366	35,490	\$ 42,414,544	NPCR	NPCR	NPCR
2006	5,674	151,359	\$ 133,945,110	337	23,322	\$ 25,546,945	NPCR	NPCR	NPCR
2007	5,060	168,302	\$ 99,937,872	353	20,590	\$ 15,798,007	NPCR	NPCR	NPCR
2008	4,609	166,638	\$ 111,559,018	171	14,180	\$ 14,444,860	NPCR	NPCR	NPCR
2009	4,243	139,688	\$ 82,077,669	47	3,937	\$ 3,189,571	155	14,030	\$ 5,837,545
2010	3,930	141,881	\$ 97,701,740	205	12,815	\$ 10,494,984	56	4,621	\$ 2,697,070
2011	3,752	104,791	\$ 75,104,726	270	21,867	\$ 20,675,971	503	33,933	\$ 22,261,387
2012	3,453	123,979	\$ 78,635,665	97	8,730	\$ 6,248,340	718	45,625	\$ 28,101,515
Sinaloa									
2003	50,450	1,436,233	\$ 415,185,109	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2004	55,610	1,736,986	\$ 651,149,091	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	56,301	1,661,317	\$ 504,573,820	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	53,366	1,591,718	\$ 485,591,394	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2007	50,541	1,870,050	\$ 717,610,682	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2008	40,074	1,698,090	\$ 712,285,106	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2009	33,729	1,272,869	\$ 515,740,729	174	18,909	\$ 8,577,512	875	70,639	\$ 25,244,544
2010	36,427	1,277,545	\$ 499,631,421	508	57,913	\$ 28,962,211	2,811	244,900	\$ 100,396,569
2011	35,934	528,358	\$ 237,998,399	1,683	104,438	\$ 32,165,067	3,239	148,267	\$ 65,420,954
2012	30,456	874,676	\$ 320,665,324	8,415	794,332	\$ 235,937,376	3,667	304,442	\$ 143,956,874

Sonora									
2003	15,078	279,660	\$ 117,579,086	29	11,052	\$ 11,304,729	NPCR	NPCR	NPCR
2004	13,439	232,973	\$ 98,799,719	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2005	13,176	235,556	\$ 113,456,725	NPCR	NPCR	NPCR	NPCR	NPCR	NPCR
2006	15,019	286,483	\$ 145,889,220	492	41,857	\$ 42,784,786	NPCR	NPCR	NPCR
2007	13,448	247,384	\$ 119,210,485	194	13,160	\$ 8,378,010	NPCR	NPCR	NPCR
2008	12,445	248,946	\$ 119,704,762	129	19,632	\$ 13,974,810	NPCR	NPCR	NPCR
2009	12,322	265,668	\$ 126,238,783	274	14,538	\$ 11,351,782	NPCR	NPCR	NPCR
2010	13,800	301,559	\$ 155,008,996	567	52,382	\$ 38,820,018	NPCR	NPCR	NPCR
2011	14,973	259,411	\$ 117,508,871	612	62,766	\$ 38,675,837	265	19,419	\$ 8,929,302
2012	13,379	269,184	\$ 133,064,374	978	113,223	\$ 56,689,419	261	26,123	\$ 10,436,206