

## An Overview of Strawberry Production in Mexico

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### Introduction

Mexico was the second largest strawberry producing country in the world in 2013, following the United States (FAO, 2014). In recent years, rapid increases in acreage and production capacity of the Mexican strawberry industry have created great challenges for the U.S. strawberry industry (Suh, Guan, and Khachatryan, 2017). Over a period of 10 years (2004-2014), Mexican export to the U.S. increased approximately fourfold from 93 million pounds in 2004 to 355 million pounds in 2014 (USDC, 2015). To put this in perspective, Florida total production in 2004 and 2014 were 179 and 207 million pounds, respectively. In 2004, imports from Mexico were approximately half of total Florida production, while it became roughly two times higher than Florida production in 2014. Given the tremendous influence of the Mexican strawberries in the U.S. market, it is important to have a better understanding of the Mexican strawberry industry, particularly the strawberry production in Central Mexico, the major production area in Mexico that has the same production window and directly competes with Florida in the winter strawberry market. This article provides an overview of the Mexican strawberry production, with an emphasis on the production in Central Mexico.

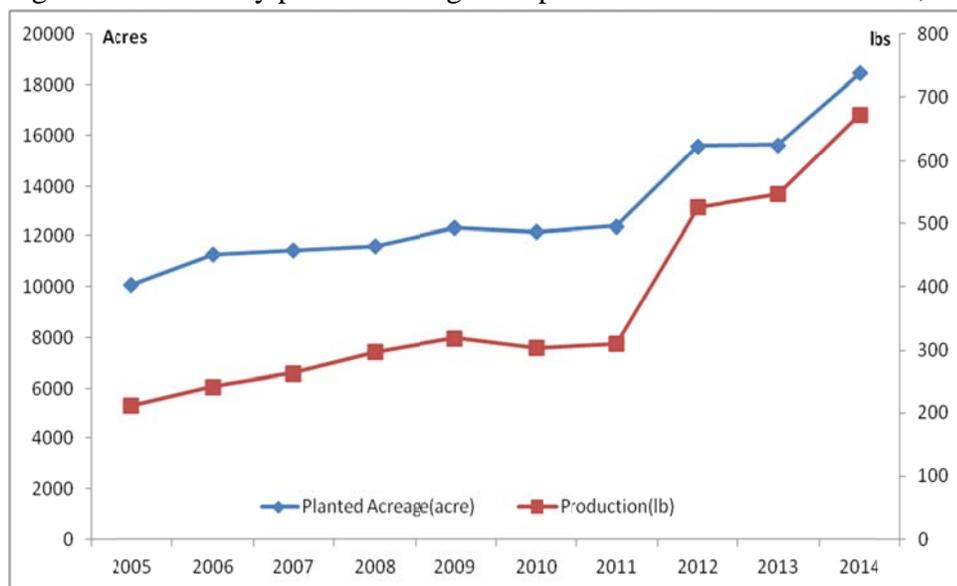
### Mexican Strawberry Production

Mexican strawberry production has experienced rapid growth over the past ten years. In 2014, Mexico's strawberry production (fresh and frozen) reached 1,012 million pounds, two and a half times its production 10 years before. Mexico has two major production areas: Baja California and Central Mexico (including Michoacán, Guanajuato, Jalisco and Mexico states). Due to geographic distance, the two areas have different production seasons. Baja California mainly produces in the summer while Central Mexico produces in the winter. The total planted acreage in Mexico was 17,310 and 24,629 acres in 2011 and 2014, respectively. Strawberry production in Central Mexico, accounting for about 65% of total Mexican strawberry volume, has led the growth of strawberry production. Due to the growing demand for winter strawberries from the U.S., the acreage in this area expanded rapidly (Figure 1). In 2011, its total planted area was 12,387 acres, and it increased to 18,458 acres in 2014, representing an approximately 50% growth. The increase in acreage, ideal weather, and changes in production technology led to the high output. Production in Central Mexico reached 673 million lbs in 2014, which is twice as much as in 2011.

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Figure 1: Strawberry planted acreage and production in Central Mexico, 2005–2014

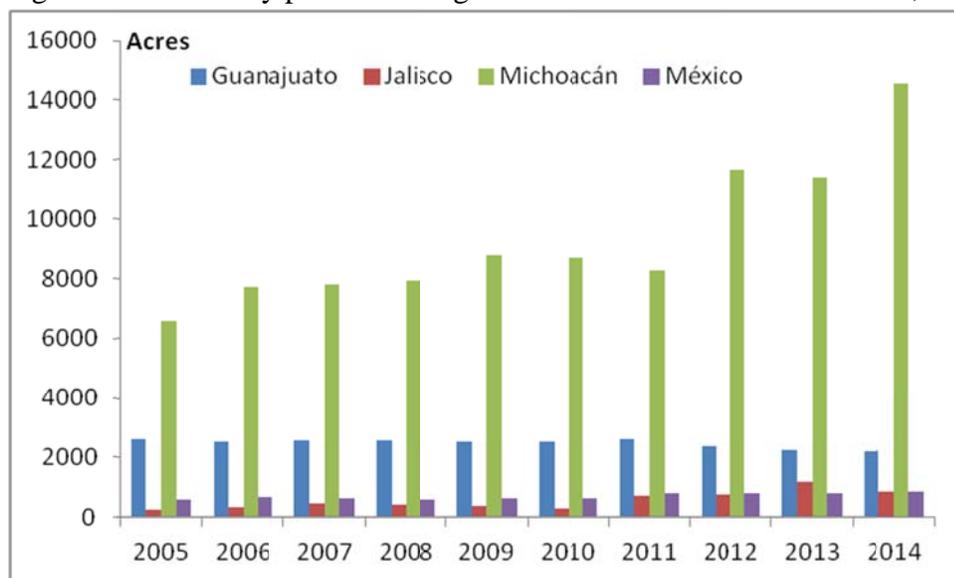


Source: Agrifood and Fisheries Information Service of Mexico (2016).

### Production Regions in Central Mexico

Michoacán is the hub of Central Mexico strawberry production with 79% of the planted area in 2014. Michoacán has a favorable geographical location and mild, temperate climate for strawberries. Prior to the 1950s, strawberry production was concentrated in the state of Guanajuato. After the production expanded to the state of Michoacán, Michoacán has seen a sharp increase in production and has become a leading producer. Meanwhile, strawberry production in Guanajuato has been steadily decreasing. In 1999, 6,140 and 9,090 acres were planted in Guanajuato and Michoacán, respectively. In 2014, their acreages changed to 2,196 and 14,569 acres, respectively (Figure 2). The valley of Zamora is the strawberry center of Michoacán in terms of acreage, output, workforce and number of agro-processing companies. Strawberries are also grown in the adjacent states, including Jalisco and Mexico states, but the total acreage is quite small there.

Figure 2. Strawberry planted acreages in four states of Central Mexico, 2005-2014



Source: Agrifood and Fisheries Information Service of Mexico (2016)

### Technologies

It is the technology that has made Michoacán stand out as one of the largest strawberry-producing regions in North America. One of critical revolutionary technologies is the use of high tunnels. About 90% of the acreage in Central Mexico is under high tunnels. High tunnels are polyethylene-covered, unheated aluminum structures. The frame of high tunnels consists of aluminum pipes bent into an arc roof as well as vertical pipes jointed with the arc on one end and fixed on the ground on the other end. Generally, arcs that make up the tunnel stand 4 meters apart; each arc spans 6 meters, covering 6 beds. The impermeable polyethylene film can be removed after the strawberry season. The film and frame could last three and five years, respectively.

Before the introduction of high tunnels, the crop suffered from freeze events, heavy rains, and intense heat. High tunnels provide protection from unfavorable weather conditions and ensure a better survival rate of strawberry transplants. They also extend the production season to increase crop yield. More importantly, strawberries grown under tunnels can meet the quality requirements for export to the US, which has attracted US shippers, in particular, California shippers to invest or engage in Central Mexico's strawberry production. California produces a low volume during the winter. Central Mexico is an ideal area for them to expand to and produce winter strawberries to meet consumer demand year round.

High tunnel production requires a significant capital investment. Constructing one hectare of high tunnels costs 235,000-250,000 pesos (\$7,600-\$8,100/acre). Growers' demand for substantial upfront capital investment usually cannot be met by the Mexican domestic banking system. By means of contracting with Mexican growers, US shippers (buyers) provide financial support in exchange for strawberry contracts from growers. This model is popular in Central

Mexico and has played a key role in driving production expansion in Mexico. As a result, other technologies used in the U.S. have been also introduced there, such as drip irrigation and use of certain chemicals. Recently, investment has been aimed at development of new varieties and food safety. As a result, Mexican strawberries have contained more and more U.S. technology and management.

### **Varieties**

The strawberry industry in Central Mexico has benefited from utilizing varieties from California and Florida. The Festival variety, which was released by the University of Florida in 2000, is estimated to account for the greatest share of planted acreage. The great favor for this variety is due to its high yield, a long shelf life, and firmer fruits that could be shipped long distance. Another variety developed by the University of Florida, Florida Radiance, is not common there as the variety is made available to only a limited number of growers to limit competition. California varieties are also popular and varieties adopted include Monterey, Camino Real, Albion, San Andreas, and Sweet Ana. Among them, Monterey is the favorite one. Camino Real produces high late-season yields of flavorful fruit and therefore is favored by farmers who keep plants for two seasons. In addition to the varieties listed above, private companies have planted their own varieties in Central Mexico. The Driscoll, Inc. has been dedicated to breeding plants resistant to diseases and pests while meeting quality standards for flavor and appearance and has developed patented varieties in Central Mexico.

Most growers buy transplants from local nurseries. Some big growers have their own nurseries and produce strawberry plants for themselves and other commercial growers. They generally choose high-elevation sites and cover nursery fields by screen (Figure 3). They buy mother plants from California nurseries and propagate daughter plants in own fields. These nursery fields are planted in December and harvested in July of next year. The average propagation rate for Festival is about 60 daughter plants per mother plant. But daughter plants' quality varies significantly. To compensate royalties charged by mother plants, sometimes small daughter plants are packed for sale. There are also other nurseries that propagate fewer plants and select only good-quality plants. This type of propagation averages about 35 daughters per mother plant. Although these plants are more expensive, they increase transplant vigor, productivity and fruit quality.

Figure 3. A nursery covered by screen in Central Mexico



### Cultural Practices

Like Florida and California strawberries, strawberries in Central Mexico are planted in double rows on soil that is mounded into raised beds. Raised beds have good internal soil drainage to provide roots sufficient oxygen for survival during periods of heavy rains (Chandler et al., 2008). Rows on each bed are spaced 9.84 inches (25 cm) apart whereas in-row spacing is 7.87 inches (20 cm) apart. Both are narrower than those in Florida (Table 1). As a result, common transplant population is 32,400 per acre (80,000 per hectare) in Central Mexico, compared to 18,000 transplants per acre in Florida. But some growers in this area use a less dense system with 24,300 transplants per acre (60,000 per hectare). High plant density results in a higher yield. Similar to Florida, Central Mexico also uses a bed plasticulture system with drip irrigation. Different from black mulch used in Florida, white mulch as a full-bed cover is the most used cover in Central Mexico. Transplants are commonly set during July and August in Central Mexico. Plants will bear fruits from November to June, a longer fruiting season than Florida. Those plants that are set earlier can start to produce fruits in October.

Table 1. Strawberry planting configuration (2-row beds)

	Florida	Central Mexico
Distance between rows(in)	12-14	9.84 (25 cm)
Distance between plants(in)	12-16	7.87 (20 cm)
Plant Population(plants/acre)	16,000-22,000	32,400 (80,000 plants/ha)

Strawberries are grown as an annual crop in the US. The plants are removed after the first harvest season and new transplants will be established in the subsequent season. However, plants are often kept to bear crops for two years in Central Mexico, which is a common practice when

using high tunnels. The crop in second year produces fewer (earlier) fruit, but growers can save on land preparation and transplant costs and avoid costly re-installment of high tunnels.

There are two major practices necessary to keep plants for two seasons. One is to water and fertilize plants in a normal way while controlling runners during the transition from one season to the next. The other is to prune plants immediately following harvest. Mow the strawberry plants down to a 2 to 4 inch height, but not cut the crowns, and clear leaves out of the beds and drainage (Figure 4). Pruning is to rejuvenate the plants and maintain their productivity, while cleanup helps reduce disease pressure. Strawberries in the open field are generally grown on an annual basis since plants do not grow well in the rainy weather of April and May.

Figure 4. Strawberry rejuvenation pruning in Central Mexico



### **Yield, Harvesting and Marketing**

In Central Mexico, harvest begins in October and the season continues until June, with peak harvest occurring from January to March. Michoacán's strawberries reach the market first with high prices, whereas Guanajuato starts the season late and receives a relatively low price. There are three market destinations for strawberries under high tunnels in Central Mexico: fresh export market, fresh domestic market, and domestic processing market. Strawberries in open fields are only supplied to domestic markets since their quality is often not up to the export standard.

Production under high tunnels has higher yields. The yield of the first year plants is usually around 6,675 flats per acre (60,000 kg/ha), and that of the second year plants is about 4,675 flats per acre (42,000 per hectare), 70% of that of the first year plants. Under high tunnels, about 30% of the acreage is second-year crop. Approximately 25-30% of strawberries under tunnels are supplied to the fresh export market, while about 60% of the harvest is sold for processing and the remaining sold to domestic fresh market. Early season fruit have good quality,

and most of them are exported. Export continues from November to March, and sometimes extends to April but could terminate sooner in February depending on the U.S. import demand and the fruit quality. Exported strawberries receive the highest price, followed by fresh domestic strawberries, and then by strawberries for processing. In the 2013/14 season, growers received prices of 25-28.5 pesos/kg, 9 pesos/kg, 8.5 pesos/kg for fresh export, fresh domestic, and processing strawberries, respectively. The large price differential has motivated growers to produce more and more strawberries under high tunnels for export market.

### **Concluding Remarks**

Mexican strawberry production capacity has been increasing rapidly over the last decade. Central Mexico has been the main source of growth; acreage in Central Mexico increased by approximately 50% over 2011-2014. A combination of government subsidies under the Mexican Strategic Project for Protected Agriculture launched in 2009 (Diario Oficial, 2010; Victoria, van der Valk, and Elings, 2011) and foreign direct investments (FDI) from America may have been the main driving force. High tunnels are a widely adopted technology. Adoption of the high tunnel technology significantly increased the yield. The Agrifood and Fisheries Information Service of Mexico (2016) reported that average Central Mexican strawberry yield was approximately 5,000 flats per acre during 2013-2015 (covering both high tunnel and open-field), which is significantly higher than that of Florida (3,000 flats).

Mexican strawberry production has a major advantage in labor cost and labor supply. The same advantage has also boosted the growth in other commodities such as tomatoes and peppers (Wu, Guan, and Suh, 2017). As a labor-intensive operation, strawberry production in Mexico has great potential. However, Mexican strawberry export is almost exclusively destined for the U.S. market, which poses a risk to both Mexican and American growers. Oversupply in the U.S. market will cause damage to both Mexican and the U.S. strawberry industry. Developing Mexican domestic market and diversifying export destinations will make the industry more sustainable.

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