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# MICHIGAN TART CHERRY PROCESSORS: ISSUES AND STRATEGY 

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# MICHIGAN TART CHERRY PROCESSORS: ISSUES AND STRATEGY 

Lourdes Martinez and Suzanne Thornsbury

## Introduction

Michigan accounts for approximately 70 percent of the total number of tart cherry processing firms in the U.S. Changes in preferences of consumers and increasing participation of global competitors are driving down demand for traditional tart cherry products and imposing new pressures on the U.S. industry, particularly in Michigan.

The objective of this report is to document main characteristics of the tart cherry processing industry in Michigan; namely, business characteristics, category of products, supply sources, and market outlets. Also, the study aims to assess business strategies and future expectations for the industry in Michigan.

Interviews with managers of tart cherry processing companies were conducted to document the objectives of this research. For the purpose of this project only processing companies that at the time of the interviews reported processing raw tart cherries were contacted. Nineteen firms were selected from the Cherry Marketing Institute 2003 Statistical Handbook (CMI, 2003) and contacted for personal interviews in 2004.

The scope of the study allows the results to present an important description of the tart cherry processing industry in Michigan. Moreover, results are useful indicators of where the industry's current position and challenges that participants perceive will be the most important in the future.

## Characteristics of the U.S. and Michigan Tart Cherry Industry

In 2004, total U.S. tart cherry production equaled 215 million pounds. More than 90 percent was processed in 166 medium to small processing and remanufacturing facilities in Michigan, Wisconsin, New York, Utah, Washington and Pennsylvania. However, this industry is highly concentrated in Michigan where approximately 70 percent of total production and processing occur (Table 1)

Table 1. Total Tart Cherry Production and Number of Processing Firms by State, 2004.

| State | Production <br> (million Ibs) | Percentage of <br> Production | Number of <br> Firms | Percentage of <br> Firms |
| :--- | :---: | :---: | :---: | :---: |
| Michigan | 145.0 | 67.4 | 114 | 68.7 |
| Wisconsin | 8.0 | 3.7 | 22 | 13.3 |
| New York | 7.2 | 3.3 | 7 | 4.2 |
| Utah | 26.0 | 12.0 | 5 | 3.0 |
| Washington | 20.1 | 9.3 | 4 | 2.4 |
| Pennsylvania | 3.9 | 1.8 | 2 | 1.2 |
| Others | 5.0 | 2.3 | 12 | 7.2 |
| Total* | 215.1 | 100 | 166 | 100 |

Source: Cherry Marketing Institute, 2004 and Economic Research Service (ERS)
*Column may not sum to exact number due to rounding of numbers.

According to the Cherry Marketing Institute (CMI), there are approximately 114 companies located in Michigan dedicated to the tart cherry business. Among these companies, some are initial processors (i.e., raw tart cherry processors) and some are 'remanufactures or processors that further transform the initial products. Most cherry processors and remanufactures are located near growing areas in the northwest (52\%), west central (18\%) and southwest (13\%) regions. The east side of the state accounts for 17 percent of total number of processors in Michigan, but these processors in general do not handle raw cherries and focus on remanufacture (Figure 1) .


Figure 1. Michigan Tart Cherry Processors and Remanufactures by Region, 2004.
(Source: CMI, 2004)

## Scope and Methodology of the Project

This research included only those initial processors that at the time of the interview were processing raw tart cherries. During the winter 2004-2005, according to CMI there were 26 firms processing raw tart cherries (CMI, 2003). Out of this total of 26 companies, 2 companies shared ownership but were under different names, five companies indicated that they were not processing cherries anymore, and six companies declined to participate. In the end, 13 managers agree to participate in a round of personal interviews. Participant firms represented 68 percent of total number of firms currently processing raw tart cherries (19), and approximately 87 percent of total tart cherry volume processed in the state ${ }^{1}$ (Table 2).

Table 2. Characteristics of Michigan Tart Cherry Processing Firms Interviewed

| Category | Number |
| :--- | :---: |
| Participants | 13 |
| Non-participants | 6 |
| No longer a tart cherry processor $^{*}$ | 5 |
| Same company under different name | 2 |
| Total | 26 |

*The category "no longer a tart cherry processor" includes firms that went out of business and firms that are currently remanufacturing or marketing end products.

## Category of Business

During the interviews, processors were asked to describe their business operations, business strategy and perception of the future regarding their tart cherry activities.

Processors categorized business operation according to the following descriptions:

- Independent processor: processors described themselves as financially and commercially independent from any farm operation.
- Grower-processors: processors stated they grow and process their own fruit under the same business operation.
- Co-op processor: members are farmers and they own the processing facility. They only process production from members.
- Other type of business: processors are co-op members on the production side of certain products, but they are independent processors for other categories of products.

[^0]Most respondents reported themselves to be under the category 'independent processor' (54\%). Twenty-three percent of respondents answered that their operations were consolidated under a grower-processors type of business, and 15 percent responded as co-op processors (Figure 2). The volume of fruit handled and the type of business category was not correlated.


Figure 2. Michigan Tart Cherry Processors by Category of Business, 2004.

## Tart Cherry Products

Over the last five years, most respondents have processed a variety of raw fruits and vegetables including tart cherries. Estimations from respondents indicate that on an average year ${ }^{2}$ companies process approximately 15 million pounds of tart cherries, with a minimum of 3 million pounds processed and a maximum of 57 million pounds. Out of those firms processing apples, they process approximately 45 million pounds of apples. Similarly, among those processing sweet cherries, they handle approximately 4 million pounds per year, and 3.2 million pounds blueberries annually per company (Table 3).

Table 3. Volume of Primary Raw Fruit Processed in Michigan by Participating Companies ${ }^{3}$.

| Fruits | Average | Minimum | $-------------------(M i l l i o n ~ P o u n d s)-------------------------$ |
| :--- | :---: | :---: | :---: |
| Apple | 44.7 | 1 | 40 |
| Tart Cherry | 15.1 | 3 | 57 |
| Sweet Cherry | 3.8 | 0.005 | 20 |
| Blueberry | 3.2 | 1 | 6.5 |

According to the USDA, frozen cherries represent more than half of processed cherries, followed by canned cherries with approximately one-third, with specialty products such as brined, dried, juice and wine, making up slightly more than one-tenth of

[^1]processed tart cherry products (USDA, 2002). This information is consistent with the information collected from Michigan processors. In 2004, the main category reported for processed products were five-plus-one (5+1), individually quick frozen (IQF) ${ }^{4}$, and canned cherries (CMI, 2003). Table 4 presents the main characteristics of different processed tart cherry products.

Table 4. Characteristic of Main Category of Processed Tart Cherry Products

| Product form | Product presentation | Size |
| :--- | ---: | ---: |
| Canned unsweetened | $\# 10$ can | 108 oz. or 3.06 kg. |
| Canned unsweetened | $\# 303$ can | 16 oz. or 454 g. |
| Pie filling | $\# 2$ can | 21 oz. |
| Pie filling | $\# 10$ can | 7 lb. |
| $5+1$ | Container | 30 lb |
| IQF | Container or other | 30 lb. | Source: CMI, 2004

Participants indicated that in an 'average' year' ${ }^{5}$, their total production of $5+1$ products averaged approximately 68.1 million pounds per year. Total production of IQF averaged 19.5 million pounds and canned cherries 16 million pounds per year. Production of other products such as dried cherries and other specialty products (e.g., wine, food supplements, etc.) averaged approximately 3.3 million pounds and 7.3 million pounds respectively per year. Total production of juice concentrate was reported as approximately 344,550 gallons per year (Table 5). Table 5 presents an estimated average ${ }^{6}$, minimum and maximum production by participant firms.

[^2]Table 5. Annual Total Average, Minimum and Maximum Production Estimates by Participant Firms ${ }^{1}$

| Products | Total Production <br> in an Average <br> Year | Participant Firms <br> Annual <br> Average |  |  |
| :--- | :---: | :---: | :---: | :---: |
| Production |  |  |  |  | Minimum $\quad$ Maximum

${ }^{1}$ Average, minimum and maximum production refers to those firms producing different products
${ }^{2}$ Category other includes fresh slack pack, canned retail size, $9+1$ pack, fillings, puree, \#2 can, etc

In the Over the last 5 years, more than 50 percent of processors responded that they have maintained a stable production trend; with the exception that juice has increased. More than 20 percent of respondents answered that they have increased production whereas less than 20 percent responded they have decreased production of all these products (Figure 3).


Figure 3. Perception of Processors Regarding Production of Main Tart Cherry Products in the Last Five Years.

In the near future (i.e., 5 years from now), around 70 percent of participants who were currently producing frozen cherry products and concentrate juice expected to increase production. In contrast, out of those respondents producing dry cherries, 67 percent expected production to remain unchanged. Finally, 100 percent of participants producing canned cherries expected production to remain unchanged (Figure 4). According to most respondents, new product forms with more emphasis on health and nutrition values will likely gain market share in the future.


Figure 4. Perception of Processors Regarding Production of Main Tart Cherry Products in the Next Five Years.

## Tart Cherry Supply Source

Supplies come primarily from Michigan. Since initial processing must take place within a very short time. However, in 2002, after a disastrous crop year, imports of frozen product (i.e., completed the initial stage of processing) from other countries, especially Poland, significantly increased. Although first-stage processing has for the most part returned to high levels and imports are decreasing, there is still an important volume of imports from Poland coming to the industry (Figure 5).


Figure 5. Total Volume of Frozen Tart Cherry Imports and Polish Share of Total Frozen Tart Cherry Imports, 1999 - June 2005.
Source: Stat USA, 2005.

Respondents indicated they expect tart cherry volumes sourced from Michigan to be variable in the coming years. Most respondents (77\%) expect to see a decrease in volume produced from southwest Michigan. Expectations regarding volumes from northwest Michigan are mixed. Approximately $2 / 3$ of respondents indicated they expect volume to decrease and a similar percentage expect volumes to remain at current levels. Regarding west central Michigan, 38 percent of respondents expect an increase in volume produced (Figure 6). Main factors cited for downward pressure on volume produced are age of trees and subsequently slight or no replacement of trees. Also, urban development, variation of climatic conditions, and demand for other fruits such as apple or blueberries were mentioned as main downward pressure factors.


Figure 6. Expectation of Tart Cherry Supply to the Industry from Different Michigan Regions in the Next Five Years

Over the next five years, tart cherry volumes from Wisconsin, Utah and New York are expected to decrease mainly due to urban development, age of trees without replacement, and climate change. Most processors (54\%) indicated that production from Washington State is likely to increase due to new plantings and focus of this industry on juice concentrate and dry cherry production (Figure 7)


Figure 7. Expectation of Tart Cherry Supply to the Industry from Different States in the Next Five Years

Finally, more than 60 percent of respondents indicated they were not very familiar with production in Poland or Hungary ${ }^{7}$. Between 25 and 30 percent of respondents did anticipated increasing production trend from these two countries due to their expanded access to the European market (Figure 8)

[^3]

Figure 8. Expectation of Tart Cherry Supply to the Industry from Poland and Hungary in the Next Five Years

Among key changes in the method of procurement of raw tart cherries, 62 percent of processors responded that currently there are more commitments between growers and processors. These commitments are more engagement of co-op agreements and more written agreements with growers. Only 15 percent responded that there is more direct buying from farmers without any specific agreement, and 23 percent answered that there has not been any significant change in procurement methods (Figure 9).


Figure 9. Perception of Participants Regarding Main Changes in Methods of Tart Cherry Procurement

## Main Markets for Tart Cherry Products

Raw tart cherry processors market primarily for remanufacture (63.4 percent). Also, they sell directly to retail outlets (13.4 percent), exports ( 9.4 percent), food services (4.6 percent) and government programs ( 2.2 percent). Other outlets ( 7.1 percent) include brokers, cooperatives and direct sales (Figure 10).


Figure 10. Average Percentage of Tart Cherry Product Sales by Different Outlets

Around 39 percent of respondents indicated that the most important changes in marketing of cherry products were new requirements of customers and changes in the way products are marketed. For example, some buyers request cheaper products, marketing promotions, stricter quality controls and increasing private label participation in retail store. Also, consolidation at the retail level has reduced the overall number of buyers. For 23 percent of respondents satisfaction of end-consumers has been the main driver of marketing changes. These requirements are more demand for ready-to-use products, decrease of bakery products (e.g., pie fillings), and more concern for health issues. Fifteen percent of processors indicated coordination among processors represented a major change, especially more sales coordination, more agreements with growers, and the formation of a processor cooperative. In contrast, 23 percent of processors felt that there has not been major changes in marketing of tart cherries (Figure 11).


Figure 11. Perception of Participants Regarding Main Changes in Marketing of Tart Cherry Products

In terms of geographic distribution of markets, the domestic market is the main outlet for U.S. tart cherry products. In 2003 and 2002 among all processors interviewed, exports represented only 12 percent of total sales. During 2002/2003 period, more than 80 percent of total sales were in the U.S., specifically in the Midwest. For companies exporting cherry products, exports to Europe represented 65 percent of total export sales, Asian countries accounted for 16percent of exports sales, and other countries like Canada and Mexico had 19 percent share of exports sales during the same period (Figure 12).


Figure 12. Estimated share of Total Processed Tart Cherry Exports by Participants who were Exporting Cherry Products, 2002 - 2003

Although the United State Trade Commission does not report exports of specific tart cherry products from Michigan, the survey information on exports to different world
regions is consistent with U.S. trade statistics (STAT-USA, 2005). In 2003, total share of U.S. exports to European countries represented approximately 51 percent of total exports. Exports to Asian countries were around 12 percent of total exports during the same year (Figure 13).


Figure 13. Main Export Markets for U.S Frozen Tart Cherries, 1999 - June 2005
Source: Stat-USA, 2005

## Quality Characteristic Requirements

In Michigan, quality standards for red tart cherries are based on the USDA
Grading Manual for Frozen Ripe Red Tart Pitted Cherries (USDA AMS, 1977) (Table 6). Most companies reported having their own, stricter, private standards applied when receiving products. According to most respondents, on average the first quality requirement is a fruit free of defects, the second requirement is good character, and third requirement is good red dark color. However, some processors indicated that the first requirement is good character and free of decay. Other important requirements are free from harmless materials (HEM), free from pits, and good maturity (Figure 14).

Table 6. AMS Quality Characteristic Grading and Percentage of Participants Requesting these Quality Characteristics.

## Characteristic <br> Requirement

| Color | red dark color, no scald |
| :--- | :--- |
| Size | large in size |
| Defects | blemished, mutilated, other |
| Decay | free |
| Character | firmness, meatiness of flesh, toughness, free of stem |
| Harmless extraneous material | Free from HEM |
| Flavor | degree Brix |
| Pits | Free |
| Maturity | Good maturity |

Source: USDA Grading Manual for Frozen Ripe Red Tart Pitted Cherries, 1977


Figure 14. Percentage of Respondents Requesting Specific Quality Characteristic in Order of Importance

The majority of processors (54 percent) indicated there are no systematic differences in quality characteristics of tart cherries produced in different regions of Michigan. Around 40 percent of participants responded that some differences in quality and size are due to weather conditions between the northwest, west central and southwest regions. Finally, 8 percent indicated they do not know about variations in quality characteristics among different Michigan regions (Figure 15). Some problems that were cited include blemishes that slow down line of production, oversized fruit, soft fruits, and soft pits that left fragments after processing.

With regard to other regions in the U.S., over 60 percent of respondents indicated they were not familiar with fruit characteristics from Wisconsin. Around 15 percent of respondents reported that there are some quality differences between Michigan and Wisconsin, mainly due to fruit degree Brix ${ }^{8}$ content or weather conditions affecting quality characteristics. Also, 15 percent of participants indicated that there is no significant difference between fruits from Michigan and Wisconsin (Figure 15).


Figure 15. Percentage of Respondents Indicating Main Quality Characteristics of Tart Cherry Fruits in the US

Forty-five percent of participants did not know any quality characteristics of fruits from Utah. Approximately 30 percent indicated the main quality difference is due to size of fruits, and over 20 percent answered that the western fruits have more pit problems. Finally, 30 percent of respondents did not know about fruits from Washington. Almost 10 percent answered the main difference is in the size of the fruit (Figure 15).

Out of the main countries producing tart cherries, processors indicated their main competition was imports from Poland. However, according to participants, Polish cherries are generally different from Michigan cherries. First, cherries from Poland are of a different variety (Morello) which is reportedly darker, but with a higher degree Brix. Second, cherries from Poland were reported to have more pit problems slowing the processing process. Most participants did not have any knowledge about quality characteristics of fruit from Hungary or other countries, such as Russia or Turkey (Figure 16).

[^4]

Figure 16. Percentage of Respondents Difference between cherry fruits in the rest of the World

## Variation in Volume and Quality of Production

As with all agricultural products, tart cherry production also experiences variations in volume and/or quality across years. In most cases Michigan tart cherry processors manage variation of quality characteristics on a year-to-year basis. Sixty-nine percent of companies manage variation using some type of mechanical sorting to grade quality, or simply grading cherries differently, diverting lower-graded fruits, 8 percent use other statistical means to grade fruit. However, almost one forth (23 percent) of processors responded that they cannot manage quality variation between years.

In terms of volume variation, shortage in local production sometimes is replaced by imports (46 percent). However, most processors responded they would not import fruits and would instead process less volume the year that this kind of event occurs (54 percent). Sixty-two percent of processors answered they do not own multiple facilities to process tart cherries, 38 percent own multiple facilities, all of which are located in Michigan. In general, most processors responded they find it very difficult to manage variation of volume over the years.

## Mission, Marketing and Vision Strategies

Firms use business strategy to determine basic long-term goals and objectives of an organization. The strategy of a firm relates to the current and future decisions an organization faces. These decisions sometimes determine success or failure of an enterprise (Besanko et. al., 2000). In order to analyze the business strategies of tart cherry processors, respondents answered basic questions regarding mission and marketing strategy, management of volume and quality variation over the year, and visions of competitive pressure in the domestic and international market.

The purpose of a mission statement is to identify what makes a business distinctive and what kind of activities a business performs in order to succeed in its own industry (Peterson, 2002). In order to analyze mission statements of processors, they were categorized according to which business relationships are most valuable to their
organization. The main categories were relationships with re-manufactures, growers, retailers and end-consumers.

Most processors (39 percent) indicated that their main focus is to satisfy demand of re-manufacturers, which are their main customers. Other processors aligned their mission to satisfy demand of retailers ( 23 percent) or end-consumers ( 15 percent). Finally, 23 percent of participants said their mission was to increase grower's profitability (Figure 17).


Figure 17. Main Focus of Processor Mission Statements.

Organizations set marketing strategies to generate specific results and meet their objectives or business mission (Peterson, 2002). Forty-six percent of participants indicated that their main marketing strategy is to develop new value-added products, such as ready-to-use tart cherries, cherry supplements and other products. Thirty-nine percent base their marketing strategy on following what re-manufacturers, retailers and brokers demand in order to respond to changes in the market. Finally, 15 percent of participants responded they have not define a marketing strategy (Figure 18).


Figure 18. Main Marketing Strategies Utilized by Participants

Vision statements are expressions of where managers see their companies within a certain time-frame. Most respondents (46 percent) indicated that maintaining profitability of the company is the most important factor in order to be successful in the future. For 15 percent of processors, expansion into new markets and maintaining quality are important key values. For 8 percent of respondents, introducing new value-added products are critical factors to assure success of their company in the future. Additionally, a successful future also depends on long term relationships with other processors and growers, keeping up with emerging technology, and marketing campaigns in order to introduce consumers to cherry products.


Figure 19. Main Focus of Company Vision Statement.

Regarding an overall vision for the Michigan fruit industry, respondents showed different opinions than those they expect for their companies. Fifty-four percent of respondents indicated that the fruit industry needs to develop value-added products, and these products should not necessarily be new processed products, but rather products in forms that benefit consumers, such as ready-to-use packs, healthy desserts and others. Other respondents indicated that the industry needs to maintain constant supply (23 percent), adapt to global market requirements (15 percent) and continue with more cooperative work (8 percent).


Figure 20. Main Focus of Vision Statement for the Overall Michigan Fruit Industry

Future scenario describes some expectation to where each manager thinks the company will be, in this specific case, in 10 years. Most processors suggested they expected their companies to remain the same ( 46 percent). Thirty-eight percent of processors expect their companies to grow and increase their market share, and 15 percent of respondents expect slight changes in production technologies or equipment (Table 21).


Figure 21. Expected Future Scenario for their Company

## Domestic and International Competitive Pressures

Competitive pressures are what processors view as threats to growing or maintaining their current market share. According to respondents, in the domestic market the main competitive pressures are other berries (e.g., blueberries, cranberries), apple production and prices of other red fruits. Additionally, processors indicated urban development and increasing use of land for housing as major incentives to abandon cherry production. Other domestic pressures are increasing imports from the west coast (e.g., Washington and Oregon) and from other countries (e.g., Poland and Hungary), quality and price variation over the years, decrease in number of processors working in cooperation with other processors, inter-industry competition, and fewer buyers because of consolidation of retailers, wholesalers and brokers. Some respondents also mentioned health-oriented products and consumer preference for fresh products (more than 90 percent of tart cherry production is processed).

Main competitive pressures in international markets are from the European Union (EU), Turkey, and, especially Poland. According to respondents, duty issues, exchange rates, and cost structure in these countries (e.g., low wages) are important factors that increase the competitive pressure for Michigan products. However, several processors (31\%) indicated that they were not very familiar with competition in markets outside the U.S.

## Summary

The Michigan tart cherry industry comprises almost 70 percent of total U.S. production and processing. For this study, processors who were handling raw tart cherries in Michigan were contacted for interviews to document their current situation and assess their future expectations facing new global tart cherry markets.

Most participants were independent processors (54 percent). Others reported their firms were consolidated as grower-processors (23 percent), and cooperative processors (15 percent). These processors are mainly located near growing areas in the northwest region of Michigan.

During a typical year total production of frozen products such as $5+1$ and IQF products average approximately 68.1 million pounds and 19.5 million pounds, respectively. Other important processed products are canned, dried cherries, specialty products (e.g., wine, food supplements, etc.) and juice. For the future, an increase is expected in production of frozen cherry and concentrate juice. According to most respondents, new product forms with more emphasis on health and nutrition values will be more competitive.

Supply comes primarily from Michigan. Respondents indicated they expect tart cherry volumes from Michigan to be variable in the coming years. Main factors influencing variation in volume produced are age of trees, urban developments, climatic conditions and demand for other "red" fruits (e.g., apples, sweet cherries).

Tart cherry volumes from other states are expected to decrease mainly due to urban developments, age of trees without replacements and climate changes, except Washington production. Surprisingly, more than 60 percent of respondents indicated they did not know about production in other countries.

Among key changes in method of raw product procurement are more commitments from growers and processors and more direct buying from farmers. Twenty-three percent of participants indicated that there has not been any significant change in procurement methods.

Raw tart cherry processors market primarily for remanufacture ( 75 percent of total sales). Around 39 percent of respondents indicated that the most important changes in marketing of cherry products have been new requirements from customers and changes in the way products are marketed.

Regarding quality requirements, most companies reported having their own private standards which they apply when receiving products. According to respondents, size, character and color are the main quality characteristics when grading tart cherries.

Most processors (54 percent) indicated there is no difference between quality characteristic of tart cherries produced in different regions of Michigan. Out of the main countries producing tart cherries, processors indicated their main competition comes from imports from Poland, but a great number of participants did not know about the quality characteristics of fruit from Poland or other main producing countries.

In terms of business strategies, most processors (39 percent) indicated that their main focus is to satisfy the demand of their main customers which are re-manufacturers.

For around forty-six percent of participants, the main marketing strategy is to develop new value-added products. Similarly, 46 percent of managers indicated that maintaining profitability of the company is the most important factor in order to be successful in the future. Regarding visions for the Michigan fruit industry, 54 percent of respondents indicated the industry needs to develop more value-added products.

In general, processors expect their companies to remain unchanged in market share in the future (46 percent). Thirty-eight percent of processors expect their companies to grow and increase their market share.

Processors view other berries (e.g., blueberries and cranberries), apple production and prices as competitive pressures in the domestic market. Other competitive pressures are healthy products and consumer preference for fresh products. Main competitive pressures in international markets are production in the European Union (EU), duty issues, exchange rates, and cost structure (e.g., low wages).

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[^0]:    ${ }^{1}$ The numbers of firms currently processing raw tart cherry were selected from the 2003 CMI statistical handbook, the total volume processed according to Michigan Agricultural Statistics, 2003-2004.

[^1]:    ${ }^{2}$ Average year represents a year when production and processing activities were not significantly affected by any natural or economic event.
    ${ }^{3}$ Average, minimum and maximum volumes are for those companies that answered processing these fruits.

[^2]:    ${ }^{4}$ Individually quick frozen (IQF) cherries do not have sugar added. Five-plus-one products have sugar added in the following ration: " $5+1$ products conversion factor is 33.33 pounds of fresh tart cherries for $5+1$ fruit-to-sugar ratio calculated by multiplying finished weight by 1.11 to determine RPE". Cherry Marketing Institute Statistical Handbook, 2003
    ${ }^{5}$ Again, average year represents a year when production is not affected by any weather effect and markets do not experience any significant shock.
    ${ }^{6}$ Average represents the sum of total volume produced divided by the number of respondents that, at the time of interviews, were producing the specific product.

[^3]:    ${ }^{7}$ Processors were also asked about other countries such as Russia and Turkey, which are important global tart cherry producers. However, most respondents indicated they did not have knowledge of production regarding these countries.

[^4]:    ${ }^{8}$ "Degree Brix is used in the food industry for measuring the approximate amount of sugars in fruit, fruit juices, wine, soft drinks and the sugar production industry. For fruit juices, one degree Brix is about 1-2 percent sugar by weight of the fruit juice and this usually correlates well with perceived sweetness" Definition available at http://en.wikipedia.org/wiki/Brix.

