Tart Cherries: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

Prepared by the Economic Research Service,
U.S. Department of Agriculture

for the
Office of Risk Management

August 26, 1996

Contributors:

Glenn Zepp (202) 219-0771
Joy Harwood (202) 219-0770
Charles Hammond (Summer intern, NCSU)
Agapi Somwaru (202) 219-0395

Table of Contents

Introduction 6

The Tart Cherry Tree 6
Varieties 6
Pollination 8

The Tart Cherry Industry 8
Location 8
Farms with Tart Cherries 9

The Tart Cherry Market 9
Supply 9
Demand 16
Prices 16

Environmental Requirements and Production Practices 19
Climate 19
Soils 19
Orchard Sites 19
Propagation and Planting 20
Orchard Management 20

Harvesting 21

Processing 23

Marketing 23

The Federal Marketing Order 24

Costs of Production 24

Tart Cherry Organizations 26
The Cherry Marketing Institute 26
The Michigan Agricultural Cooperative
Marketing Association 26

Production Perils 26
Frosts and Freezes 26
Excessive Rain 27
Excessive Heat 27
Hail 27
High Winds 28
Diseases 28
Insects 30
Birds 30

State Analyses 31
Colorado 31

Michigan 31
New York 34
Oregon 37
Pennsylvania 38
Utah 39
Washington 40
Wisconsin 40

Ad Hoc Disaster Assistance for Tart Cherries 42

Insurance Implementation Issues 44
Demand for Insurance 44
Adverse Selection 44
Reference Prices 45
Estimating “Appraised Production” 45
Moral Hazard 45
A "Dollar Amount" or Revenue Insurance Policy 46
Individual Yield Data 46
Insuring Trees 47

References 48

Executive Summary

The red tart cherry, *Prunus cerasus*, is a perennial tree fruit related to the plum, peach, apricot, almond, and numerous other species of the north temperate zone. It is grown commercially for its tart and juicy fruit, which is primarily used in baking and cooking. Fully ripened tart cherries may be eaten raw, but are too acid for many palates. The raw fruit stores poorly and its shelf life is too short for the fresh-market trade.

Most tart cherries are grown in four states bordering the Great Lakes--Michigan, New York, Pennsylvania, and Wisconsin. These states produce 85-95 percent of the U.S. crop in most years. Michigan is the dominant producer, accounting for 70-80 percent of U.S. output. Except in Pennsylvania, tart cherries in these states are located in areas adjacent to one of the Great Lakes. The lakes moderate the spring-time climate, reducing the chances of killing frosts when the trees are in bloom.

In Pennsylvania, tart cherries are grown on the eastern slopes of the Blue Ridge Mountains, where good air drainage helps protect blossoms against frost damage during the critical bloom period.
Utah, Oregon, and Washington growers also produce tart cherries commercially.

The year-to-year variation in tart cherry output is significant, with U.S. production ranging from 190 million pounds to 396 million pounds between 1985 and 1995. Since Michigan dominates the domestic industry, U.S. output rises and falls with variations in Michigan's output. A short crop in Michigan means a short U.S. crop and high prices for all U.S. areas, while a large Michigan crop leads to low prices in all areas. Killing spring freezes in Michigan (or the lack thereof) are the primary cause of variations in annual crop size.

Another factor contributing to variations in production, however, is a tendency for the trees to bear a large crop following years of low yields. As with many fruit and nut trees, cherries build up energy reserves during short-crop years, and tend to produce a bumper yield during the following year.

The demand for tart cherries is highly inelastic. This means that grower prices rise sharply during years with a small crop, and fall sharply when there is a large crop. For example, farmers received more than 46 cents a pound in 1991, when only 190 million pounds of tart cherries were produced. This is more than seven times the 6 cents a pound received in 1987 and 1995, when output totaled 359 and 396 million pounds, respectively.

Climate, particularly the temperature range in an area, is the most important factor affecting the geographic distribution of tart cherry production. Generally, tart cherry trees do not thrive in the southern and central states where summers are long and hot.

Extremely low winter temperatures also may damage tart cherry fruit buds. Further, late spring frosts are incompatible with producing tart cherries, as the blossoms and young fruit are very susceptible to injury. Temperatures below 28° F can kill a high percentage of unprotected blossoms and fledgling fruit.

Locating the orchard in areas with good air drainage helps reduce the chances of crop failure due to frost. This is because cold air settles to lower levels, and orchards occupying sites higher than the surrounding areas are less likely to be injured by frost than those at the lowest elevations. An additional advantage of locating orchards on higher elevations is that the soil on such sites is more likely to be well drained.

Large bodies of water also can reduce the chances of crop failure due to frost. Orchard sites adjacent to large bodies of water are less likely to suffer frost damage to the blossoms and fruit buds than orchards on sites without water nearby. Large bodies of water provide a cooling effect during warm spring days, which slows bud development and delays the bloom period. In addition, large bodies of water provide a local warming effect during cold spring nights, reducing the likelihood of freezing temperatures.

The greatest potential demand for tart cherry insurance likely exists in Michigan. Michigan has the largest acreage planted to tart cherries of any state in the U.S., and has a relatively high probability of yield loss due to late spring-time frosts, especially in the central and southern areas of the state.

Growers in other states would also likely have an interest in tart cherry insurance. This is particularly true of growers in areas subject to crop loss due to late spring-time frosts.

Because of the marked inverse relationship between Michigan’s production and producer prices in all states, farmers with low yields may or may not experience lower revenues. In a similar vein, tart cherry returns may be quite low during some years when yields are relatively high because of low market prices.

Because low yields do not always translate into low returns, a "dollar amount" plan (based on the concept of revenue insurance) may be appropriate in insuring tart cherries. With such a provision, growers would need to demonstrate a revenue loss in order to collect an insurance indemnity. Such a plan may reduce the cost of insurance to producers and still provide income protection due to yield losses.

Tart Cherries: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

Introduction

The red tart cherry, *Prunus cerasus*, is a perennial tree fruit related to the plum, peach, apricot, almond, and numerous other species of the north temperate zone. It is grown commercially for its tart and juicy fruit, which is primarily used in baking and cooking. Fully ripened tart cherries may be eaten raw, but are too acid for many palates. The raw fruit stores poorly and its shelf life is too short for the fresh-market trade.

Tart cherries are also known by other names. They are at times called “sour cherries” due to their sour flavor. They are also referred to as “pie cherries” because they are commonly used in baking, or “red cherries” because of their bright red color.

Michigan produces 70-80 percent of the tart cherries grown in the United States. Other states having commercial acreages include Colorado, New York, Oregon, Pennsylvania, Utah, Washington, and Wisconsin. The annual farm value of the U.S. tart cherry crop averaged $44 million between 1985 and 1995. The value of the crop was at a low of $19 million during the 1995 crop year, and at a peak of $88 million in the 1991 crop year (Table 1).

This report examines those aspects of the U.S. tart cherry industry that relate to the demand for crop insurance and the feasibility of developing a tart cherry insurance policy.

The Tart Cherry Tree

Varieties

There are hundreds of named tart cherry cultivars. Only the *Montmorency* cultivar, however, is of economic importance in the U.S. currently. *Montmorency* originated in the Montmorency Valley of France during the 17th century and was likely introduced into America in the late 1700s or early 1800s. Its fruit is about three-fourths of an inch in diameter and has a roundish-oblate (slightly compressed) shape. Its skin color ranges from bright red when first ripe to dark red when fully ripe. The flesh has a pale yellow color with a reddish tinge, and the juice has a light pink color and a sprightly flavor.

The *Montmorency* fruit ripens during July in most areas, with harvest extending into August in the more northern regions. *Montmorency’s* firm flesh and long harvest season make it well-suited for processing. Virtually all of the commercial U.S. acreage is planted to the *Montmorency* variety.

Table 1

Two Hungarian varieties are currently being produced on a trial basis in several states. One of these, referred to in the Michigan area as *Balatan*, reportedly "has the potential to be the first significant new cultivar planted in the United States since the introduction of *Montmorency*" (Nugent). *Balatan* blooms several days after *Montmorency*, reducing the likelihood of crop failure due to a late spring frost destroying the young fruit buds. Central Michigan reportedly had only about one-third its normal *Montmorency* crop in 1996 because of freeze damage to the fruit buds on May 13. The *Balatan* trees in that area, however, reportedly were loaded with cherries as they bloomed later than the *Montmorency* cultivar, escaping damage (Danilovich).

Like *Montmorency*, *Balatan* produces an abundant crop of firm fruit which processes well. There remains a question, however, about its market acceptance. *Balatan's* flesh and juice have a red color, whereas *Montmorency* has a light-colored flesh and juice. Unlike *Montmorency*, whose fruit retains a bright red color when cooked, *Balatan* fruit turns dark and may not be desired by U.S. consumers, who are better acquainted with a bright red cherry.

Currently, there are only a handful of bearing-age *Balatan* trees in the United States, but the acreage of this variety is expected to increase. Nevertheless, *Montmorency* will continue being the dominant variety for many years because the trees currently in the ground have many years of prime fruit-bearing life remaining.

Pollination

All commercially-important sour cherry cultivars are self-fertile and pollinator trees usually are not planted. Bees or other insects are necessary, however, to insure good pollination. Growers typically place bee hives in orchards during the bloom period to increase insect activity and assure good fruit set.

A relatively short period of warm temperatures and intense bee activity during pollen shed is usually adequate to assure a good crop. However, prolonged periods of cool, wet weather during blossoming diminish insect activity and may result in poor fruit set due to inadequate pollination.

The Tart Cherry Industry

Location

Most tart cherries are grown in four states bordering the Great Lakes--Michigan, New York, Pennsylvania, and Wisconsin. These states produce 85-95 percent of the U.S. crop in most years. Michigan is the dominant producer, accounting for 70-80 percent of U.S. output.

Except in Pennsylvania, tart cherries in these states are located in areas adjacent to one of the Great Lakes. The lakes moderate the spring-time climate, reducing the chances of killing frosts when the trees are in bloom. In Pennsylvania, tart cherries are grown on the eastern slopes of the Blue Ridge Mountains, where good air drainage helps protect blossoms against frost damage during the critical bloom period.

Utah, Oregon, and Washington growers also produce tart cherries commercially. In Utah, tart cherries are produced in areas adjacent to the Great Salt Lake and Lake Utah. In Oregon, tart cherries are produced in the Willamette Valley west of the Cascade mountains. Washington's production is located in the Columbia River Basin in the southeast central part of the state.

Farms with Tart Cherries

The U.S. Census of Agriculture reported 3,851 farms with 62,533 acres of tart cherry trees in 1992 (Appendix table 1). These numbers accounted for 347 fewer farms and 5,857 fewer acres than in 1987. Only 2,472 farms, however, reported harvesting cherries in 1992, down from 2,613 farms in 1987. Michigan accounted for 1,014 of the 2,472 farms harvesting cherries in 1992.

A vast majority of the farms with tart cherry trees are small operations. Eighty-five percent had sales of $100,000 or less in 1987 (Appendix table 2). Sixty-seven percent had sales of less than $25,000. Many of the smaller operations appear to produce a combination of fruits and vegetables, and to sell directly to consumers in local and regional markets.

The Tart Cherry Market

Fresh consumption of tart cherries is relatively unimportant. The principal market for tart cherries is processing. Frozen cherries account for the largest volume of processed product, with canning ranking second in terms of volume.

Supply

Almost all of the tart cherries consumed in the United States are produced in this country. Supply and use estimates indicate that, of the canned and frozen cherries consumed in the United States, over 99 percent were produced domestically (Table 2).

The year-to-year variation in tart cherry output is significant, with U.S. production ranging from 190 million pounds to 396 million pounds between 1985 and 1995 (Table 3). Since Michigan dominates the domestic industry, U.S. output rises and falls with

Table 2

Table 3

variations in Michigan’s output. A short crop in Michigan means a short U.S. crop and high prices for all U.S. areas, while a large Michigan crop leads to low prices in all areas. Killing spring freezes in Michigan (or the lack thereof) are the primary cause of variations in annual crop size.

Another factor contributing to variations in production, however, is a tendency for the trees to bear a large crop following years of low yields. As with many fruit and nut trees, cherries build up energy reserves during short-crop years, and tend to produce a bumper yield during the following year.

USDA estimates of total production measure the amount of cherries available for harvesting. Utilized production, in contrast, measures the cherries actually harvested and marketed. In most years, total production exceeds utilized production because some cherries remain unharvested. The proportion of the crop actually utilized depends to a large extent on the size of the crop (Table 3 and Figure 1). In a small-crop season, such as in 1991, virtually all of the cherries produced are harvested and used.

In seasons with excessively large crops, on the other hand, 20 percent or more of total production may remain unharvested. Only 79 percent of the 1995 bumper crop, for example, was utilized. Because a higher proportion of total production is harvested in small-crop seasons, utilized production may not vary as much from year to year as total production.

Tart cherry production tends to exhibit long-term trends that are determined partly by tree-planting cycles and partly by rising yields over time. Because of relatively profitable tart cherry prices during the late 1970s and early 1980s, growers planted considerable new acreage to young trees. These new trees began bearing fruit during the 1980s, resulting in substantial increases in output and unprofitable prices during the late 1980s and early 1990s. Because of low returns, growers removed more trees than they planted during these years, and acreage declined. By 1995, U.S. bearing acreage had declined to less than 46,000 acres, down from nearly 52,000 in 1986 (Table 4). Michigan’s acreage declined to an estimated 30,000 acres, down from more than 36,000 acres in 1986.

Although the acreage in bearing trees declined between 1986 and 1995, output increased due to rising yields per acre. Annual production averaged 313 million pounds between 1991 and 1995, up from 258 million pounds during the 1986-90 period. Yields rose from about 5,200 pounds per acre during the first 5 year period to 6,600 pounds during the last 5 year period (Table 5).

Figure 1

Table 4

Table 5

Because the growth in demand has lagged behind increases in output, prices and producer returns have remained relatively low in the past ten years. Except for 1991, prices have averaged 20 cents a pound or less in every season since 1986 (Table 6).

Demand

Domestic U.S. markets account for 80-90 percent of U.S. tart cherry production, with foreign buyers purchasing the remainder. The United States sold 17 million pounds of the 93 million pounds of canned production in 1995 to foreign buyers, and 17 million pounds out of 165 million pounds of frozen product.

Americans use nearly one pound of tart cherries per person per year. A large proportion of tart cherry consumption is in the form of cherry-containing products, such as pies and tarts.

Prices

The demand for tart cherries is highly inelastic. This means that grower prices rise sharply during years with a small crop, and fall sharply when there is a large crop (Figure 2). For example, farmers received more than 46 cents a pound in 1991, when only 190 million pounds of tart cherries were produced. This is more than seven times the 6 cents a pound received in 1987 and 1995, when U.S. production totaled 359 and 396 million pounds, respectively.

The apparent reason for the marked variability in prices is that cherries constitute a relatively small part of the cost of the manufactured products in which they are consumed.[1] Therefore, a change in the farm price results in only a small change in the cost of final products that contain tart cherries. Consequently, buyers can bid prices sharply higher during short-crop years in order to obtain the cherries they need without increasing the cost of the final product by a significant amount.

On the other hand, prices fall sharply during large-crop years because there is little demand for cherries other than for use in manufactured products. Further, manufacturers and retailers are reluctant to invest in expanding the demand for cherry-containing products because a current abundance may be followed by a season of shortages in which they can not obtain the fruit needed to supply newly-created demand.

---

[1] The tart cherries in a cherry pie are estimated to account for about 9 percent of the total cost of the pie (Johnson, 1993).

Table 6

Figure 2

In addition to the size of the current crop, carryover stocks of frozen and canned cherries from a previous season also affect farm prices. A large carryover from a previous season depresses grower prices, while a small carryover strengthens prices.

Environmental Requirements and Production Practices

Climate

Climate, particularly the temperature range in an area, is the most important factor affecting the geographic distribution of tart cherry production. Generally, tart cherry trees do not thrive in the southern and central states where summers are long and hot. Areas with winters that are characterized by periods of alternately high and low temperatures can also be detrimental to cherry trees. The trees break dormancy during warm periods, and may subsequently be damaged by low temperatures that can cause splitting of the trunks and limbs. Several years may be required for the injured bark and cambial tissues on afflicted trees to heal.

Extremely low winter temperatures also may damage tart cherry fruit buds. Further, late spring frosts are incompatible with producing tart cherries, as the blossoms and young fruit are very susceptible to injury. Temperatures below 28° F can kill a high percentage of unprotected blossoms and fledgling fruit (Fogle, et al.).

Soils

Tart cherries grow well on a wide range of soil types, provided that the soil is well drained. Well-drained sandy loams and other sandy soils are common in the important production areas. There also are successful orchards located on well-drained clay loam soils.

Orchard Sites

Soils and climatic conditions are critical in the establishment of a successful orchard. Tart cherries bloom comparatively early in the spring, and the blossoms and fruit buds are readily damaged by freezing temperatures. Locating the orchard in areas with good air drainage helps reduce the chances of crop failure due to frost. This is because cold air settles to lower levels, and orchards occupying sites higher than the surrounding areas are less likely to be injured by frost than those at the lowest elevations. An additional advantage of locating orchards on higher elevations is that the soil on such sites is more likely to be well drained than soils at lower elevations. Cherries thrive best on well-drained soils.

Large bodies of water also can reduce the chances of crop failure due to frost. Orchard sites adjacent to large bodies of water are less likely to suffer frost damage to the blossoms and fruit buds than orchards on sites without water nearby. Large bodies of water, such as the Great Lakes, provide a cooling effect during warm spring days, which slows fruit bud development and delays the bloom period. Later-blooming trees are less likely to be damaged than earlier-blooming trees. In addition, large bodies of water provide a local warming effect during cold spring nights, diminishing the likelihood of freezing temperatures in adjacent orchards.

Propagation and Planting

Tart cherry trees are propagated by grafting budwood from a desired variety onto a seedling rootstock. Most cherry growers buy budded trees from commercial nurserymen, and do not graft their own trees.

Two kinds of seedling rootstock are in general use--the *Mahaleb* and the *Mazzard*. The *Mahaleb* is used more extensively than the *Mazzard*. The *Mazzard* rootstock, however, is more tolerant of wet soil conditions, such as might occur on heavier soils, than is the *Mahaleb*. Several *Mahaleb* X *Mazzard* crosses, which possess desirable attributes of both parents, have been developed and are recommended in some areas.

Generally, fall is the best time of the year to plant young trees. Fall planting gives the roots a chance to become established before the trees bud out in the spring. Spring planting, however, has proven satisfactory in areas where extremely severe winters may kill newly-planted young trees.

Cherry trees are planted 16 to 24 feet apart, depending on the soil and the variety. Eighteen feet is a typical spacing in Michigan (Longstroth).

Cherry trees begin to bear small amounts of fruit about five years after planting and continue to produce for 20-25 years. Thus, the typical life cycle of an orchard is 25-30 years.

Orchard Management

The floors of tart cherry orchards almost universally are planted with a sod cover. Because of the benefits of superior air drainage, cherry orchards frequently are planted on sloping sites where soil erosion can occur in clean-cultivated orchards. Sod ground covers reduce erosion and also help check weed growth.

Like other orchard trees, cherries perform best with moderate, but not excessive, fertility. High fertility may promote excessive shoot growth and reduce fruit bud formation. Growers use a combination of experienced observation, soil testing, and leaf analysis to determine the nutritional needs of their trees.

Cherry orchards in the western desert areas (in Washington, Utah, and Colorado) must be irrigated because of inadequate natural rainfall to sustain the trees through the summer. A number of growers in the Great Lakes states also supplement natural rainfall with irrigation. Inadequate rainfall in these states during part of the growing season reduces fruit size and retards tree growth. The lack of adequate moisture can be particularly stressful on one- and two-year old trees, causing stunted growth that requires a number of years for full recovery.

Young tart cherry trees are pruned to obtain a desirable size and shape. Mature trees, however, require little pruning beyond the removal of weak branches in the interiors of the trees.

Tart cherries are susceptible to a number of insect and disease pests. Most potentially damaging insects and diseases, however, are controllable with available management practices. The exceptions are brown rot and cherry leaf spot, which can get “out of hand” during extended periods of wet weather.

Growers rely heavily on pesticide sprays for controlling insects and diseases. A typical spray program consists of 8-12 applications during a season, depending on the area of the country and on the orchard’s particular pest problems.

Harvesting

Tart cherry harvesting begins in early July in most areas and extends into August (Table 7). The most active harvest period lasts about two weeks.

Virtually all tart cherries are mechanically harvested. The cherries are shaken from the tree onto portable catching frames positioned beneath the tree. From the catching frames, the cherries roll onto conveyor belts which carry them into palleted tanks of cold water. The cherries remain in these water tanks until they reach the processing plant.

Table 7

A minuscule amount of tart cherries are hand harvested. Growers with too few trees to justify the heavy investment in harvesting equipment may hand pick their fruit.

Processing

Virtually all tart cherries are processed. Processed tart cherries are initially prepared into one of five basic forms--frozen, canned, juiced, dried, or cherries for pie filling. These products may then be used in the production of pies, tarts, and other foods.

Reportedly, there are about 75 handlers who process cherries. About three-quarters of the crop is processed by farmer-owned cooperatives or grower-owned processing facilities (Agricultural Marketing Service, 1996).

Tart cherry processors typically also process other fruits or vegetables. Some are highly diversified and process a number of different fruit and vegetable items, while others process only 2-3 commodities in addition to cherries. A few pack only tart cherries (Ricks and Hamm, 1985).

Relatively small cherry processing plants can achieve most of the cost efficiencies associated with large plants. A few of the largest growers produce enough cherries to obtain most of the potential processing economies of size. In addition, three or four moderately-large growers can jointly build a processing plant and have sufficient volume to obtain most of the economies of size associated with large-scale processors.

Marketing

The marketing channels for frozen cherries differ somewhat from the channels used for canned cherries or cherries used for pie filling. Frozen cherries are sold primarily to food processors for use as an ingredient in pies and cherry desserts. Very few cherries are sold to retail consumers as frozen cherries.

Cherries packed into retail-sized containers as pie filling and canned cherries are sold primarily to larger grocery wholesaler-retailers. Some canned cherries also are sold in institutional-sized cans to wholesalers serving institutions, small bakeries, and food service companies. A significant portion of the institutional pack is exported to European and Asian countries.

The proportion of U.S. processed tart cherries destined for the various market segments averages as follows: industrial grade frozen, 56 percent; consumer-sized cans of pie filling, 16 percent;

commercial pie filling, 8 percent; juice concentrate, 10 percent; dried, 2 percent; and canned water packs, 8 percent (USDA, Agricultural Marketing Service, May 1996).

A small quantity of tart cherries is marketed fresh through roadside stands, farmers' markets, and at orchard sites. A small quantity of fruit also is direct marketed through pick-your-own operations.

The Federal Marketing Order

On May 29, 1996, the Secretary of Agriculture issued proposed rules for a marketing agreement and order for tart cherries grown in Michigan, New York, Pennsylvania, Oregon, Utah, Washington, and Wisconsin. A primary objective of the program "...would be to improve producer returns by strengthening consumer demand through volume control and quality assurance..." (Agricultural Marketing Service, May 1996).

The proposed order would authorize the industry to regulate the volume of processed cherries sold; to specify grade, size, and maturity standards; and to require mandatory inspections. It would also authorize production, processing, and marketing research and promotion projects, including paid advertising.

The order would exclude from regulation those cherries sold in the fresh market in unpitted condition. The order would be administered by an 18 member administrative board consisting of growers and handlers and one public member, and would be financed by assessments on handlers of tart cherries grown in the regulated area.

A producer referendum on the proposed order was conducted from June 12, 1996 through July 10, 1996. The required majorities of growers and processors voted in favor of the order, and USDA has indicated that the order will be implemented (USDA, Agricultural Marketing Service, July 1996).

Costs of Production

Production budgets were located for tart cherries in Michigan and in Utah (Appendix A). The budgets were constructed nearly 25 years apart, during which input prices have increased. Because it was constructed more recently, the Michigan budget is the more useful for assessing current costs for producing cherries. Table 8 summarizes cash expenses and ownership costs from the two

Table 8

budgets, and indicates that harvesting costs are a significant portion of total production costs.

Tart Cherry Organizations

The Cherry Marketing Institute

The Cherry Marketing institute (CMI) is a marketing and promotion organization funded by growers in Michigan, Wisconsin, and Utah. It carries out promotion, export development, and the search for new uses for tart cherries. The general manager is Phillip Korson (see "Contacts" list.) State marketing orders in each of these states provide for assessing producers to support the CMI. CMI was the proponent organization representing the industry in establishing the Federal marketing order.

The Michigan Agricultural Cooperative Marketing Association

The Michigan Agricultural Cooperative Marketing Association (MACMA) is the Michigan Farm Bureau’s marketing affiliate. The intent of this organization is to provide marketing, bargaining, and other group-marketing services to its members. The Red Tart Cherry Growers Division of MACMA provides price leadership and information services to its members. Currently, its producer membership accounts for about 70 percent of the annual Michigan crop. The general manager is Randy Harmson (see "Contacts" list).

Production Perils

Frosts and Freezes

The most serious production peril in producing tart cherries is a late spring freeze. Cherries bloom relatively early in the spring and are prone to damage from late frosts or freezes which destroy the blossoms and young fruit buds. The extent of damage can range from minor reductions in fruit set to loss of virtually the entire crop. Damage may be limited to several trees in low lying portions of an orchard, or to individual orchards within a region. At other times, damage may be widespread, destroying most of the crop within a production area.

A major factor determining the location of the present tart cherry industry is the susceptibility of the area to frost damage. The bulk of the industry is located adjacent to major bodies of water, such as the Great Lakes, which moderate changes in spring-time temperatures. Late winter and early spring temperatures rise more slowly in areas adjacent to large lakes, delaying the onset of the bloom period and reducing the chances of frost damage. In addition, the water raises nearby air temperatures by several degrees on cold spring nights, further reducing the chances of frost damage.

Sometimes, the yield losses caused by frost can be so extensive that it causes market prices to rise. A widespread freeze in Michigan, for example, can reduce total U.S. production so much that the market price for cherries rises. Growers with partial yields and growers in areas without frost damage may actually have higher-than-normal returns as a result of the freeze.

Excessive Rain

Excessive rain promotes the development of cherry diseases by diminishing a grower's ability to apply and maintain fungicide sprays on the trees. Consequently, brown rot and leaf spot are more likely to develop into uncontrollable infections during damp, rainy weather than when the weather is drier.

In addition, excessive rain at harvest-time interferes with the harvesting operation and can cause cherries to absorb water and become soft. Such fruit bruises more easily and is more likely to be injured during the seeding operation than cherries that mature in drier weather. Damaged cherries are undesirable in frozen and canned products and reduce the value of the crop.

Excessive Heat

Excessive heat in itself does not appear to be a problem in tart cherry production. For example, cherries are grown successfully in Washington's Columbia Basin, where summer-time temperatures are very warm. Excessive heat, however, can exacerbate the effects of dry weather on cherry trees. Trees suffer greater stress during droughts if the dry conditions are accompanied by excessive heat.

Excessive heat is also associated with the development of "soft fruit." This is because extreme heat accelerates the ripening process. Cherries tend to soften as they ripen, and they become too fragile for processing sooner during excessively warm weather than during cooler weather.

Hail

Hail storms can devastate tart cherries over small geographic areas. Hail bruises and scars the fruit, reducing the quality and the quantity of usable product. In addition, it creates cracks in the fruit's skin, providing an avenue for brown rot infections.

When the hail damage occurs to young fruit, the resulting scar tissue may extend inward to the seed and cause the skin to adhere to the seed. This situation interferes with mechanical seed removal and slows down seeding operations at processing plants.

Production losses due to hail can range from minimal to virtually the entire crop. Because hail storms affect only small areas, they are unlikely to reduce industry output sufficiently to affect market prices. Unlike freeze losses, where growers may receive higher prices due to the market impact, growers who incur hail losses do not benefit from a price impact that could partly offset the reduced yield.

High Winds

As with hail, wind storms reduce the quality and the value of the crop due to bruising and scarring of the cherries. Physical damage to the cherry skins also creates opportunities for the introduction of the brown rot fungus. When damage occurs to young fruit, the skin may adhere to the seed, slowing down mechanical seeders and delaying the entire processing line.

Diseases

The two most destructive diseases affecting tart cherries are leaf spot and brown rot (Fogle, et al.). Both are fungal diseases. Leaf spot primarily attacks the leaves, causing various degrees of defoliation. Brown rot can infect the blossoms, leaves, shoots, and fruit.

<u>Cherry Leaf Spot</u>

Cherry leaf spot overwinters on fallen leaves. In the spring, leaf spot spores are carried by the wind to new leaves, where they germinate and promote new infections. These infections then produce additional spores which spread the disease to adjacent leaves and trees. The infected leaves eventually turn brown and drop from the tree.

In mild cases, cherry leaf spot may affect only a small number of leaves. During damp or rainy weather, however, the disease can “explode” in the orchard, infecting nearly all the leaves and defoliating the trees before the crop is harvested. Fruit on defoliated trees fail to mature normally, and are light-colored and low in soluble solids.

Rotary mowing the orchard after leaf drop in the fall helps to control leaf spot by hastening the decay of fallen leaves and reducing chances for the fungus to overwinter. The main control, however, comes through the use of fungicides.

<u>Brown Rot</u>

Brown rot is common to all stonefruit and frequently causes heavy losses among cherries. This disease can destroy blossoms, fruit, and stems. The most significant losses result from blossom blight and destruction of the fruit. Fruit may be infected in the orchard, in transit, or while being held for processing. Brown rot can develop rapidly, and a few infected fruits can lead to the destruction of all surrounding fruit.

Brown rot infection of blossoms appears as a sudden wilting and browning of the flower parts. If conditions are moist, the dead flowers are soon covered by grayish brown fungal spores that then infect the healthy fruit. Infections on the fruit begin as small, circular brown spots that rapidly increase in size and develop into a soft rot.

Infected fruits that remain on the tree shrink and dry into firm "mummies," which become a source of infection in future seasons. The brown rot fungus also infects twigs, causing oval-shaped cankers. The fungus lives over the winter in infected twigs, in fruiting spurs, and in mummified fruit on the tree or on the ground.

Three methods are used to control brown rot. Cultivating around the trees to bury the infected mummies and pruning out infected twigs during the spring and early summer helps to eliminate sources of new infections. Providing open space around the trees to assure good air circulation helps eliminate excessively moist conditions that favor brown rot. As with leaf spot, however, the main control comes from the use of fungicides.

Other Fungal Diseases

Diseases including black knot, powdery mildew, leaf rust, scab, and verticillium wilt occur to some extent on tart cherries. These diseases are usually less serious than either leaf spot or brown rot. Most of them are held in check by the fungicides applied to control leaf spot and brown rot.

Viral Diseases

Several viral diseases affect tart cherries. The most widespread are ringspot, sour cherry yellows, X-disease, and pink fruit. Viral diseases tend to gradually reduce tree vigor and, consequently, yields over a period of years.

Prevention is the best control. The most effective preventative measures include the avoidance of potential sources of infection, such as planting diseased stock or selecting sites near orchards with infected trees. Promptly removing infected trees in a young orchard also helps reduce the chances of spreading the infection to healthy trees.

Insects

The most common insect pests affecting tart cherries are black cherry aphids, plum curculios, fruit flies, and pearslugs (Fogle, et al.).

Black Cherry Aphids

This insect causes the tender young leaves of the cherry tree to curl early in the season, which checks foliage growth. Black cherry aphids rarely cause serious damage to tart cherries, however.

Plum Curculios

The plum curculio is a brown beetle that overwinters in debris in orchards or nearby areas. Soon after the trees bloom, the curculios move to the cherry trees where the females insert their eggs beneath the skin of the young fruit. The eggs hatch into curculio larvae (or grubs) which feed within the cherry fruit. Plum curculios are not reported to be a serious problem for tart cherries because they are adequately controlled by insecticide sprays.

Fruit Flies

The maggots of two species of fruit flies can infest tart cherry fruit. Maggots cause the fruit to be misshapen and discolored, and unsuitable for human consumption. Fruit flies generally are adequately controlled with the application of insecticide sprays.

Pearslugs

The pearslug, also called the cherry slug, is a slimy, dark worm that feeds on the leaves of the cherry tree. The slugs appear on the trees in May or June, and a second brood may appear in mid- to late-summer. Damage usually does not reach an economic threshold level.

Birds

Birds cause low-level losses among tart cherries. If significant damage were to occur, it would likely be in small plantings in isolated areas where feeding is concentrated among a few trees. Birds prefer sweet cherries to tart cherries, and if there are sweet cherries nearby, bird feeding will be lighter among the tart cherries.

State Analyses

Colorado

Colorado produced 1.2 million pounds of cherries in 1995, down from 1.5 million pounds in 1994. The Census of Agriculture reported 65 farms harvesting 1.6 million pounds of tart cherries in Colorado in 1992, up from 62 farms and 1.1 million pounds in 1987. Colorado's tart cherries had a farm value of $400,000 in 1995.

Colorado's tart cherries are located in Mesa and Delta counties on the western slopes of the Rocky Mountains. Superior air drainage due to the sloping terrain provides a measure of protection against late spring frosts, making this area adapted for fruit production.

All of Colorado's cherry acreage is irrigated. The majority of the orchards are equipped with permanent sprinkler systems. Cherry harvesting in Colorado takes place from early July through the first week of August.

Cherry producers in Colorado are highly diversified with other fruits, especially apples, peaches, and pears. Producers rely on small, locally-owned companies to process their fruit.

Winter temperature extremes are a major peril to tart cherry production in Colorado (Gaus). Air temperatures can change from moderate to extremely cold in a matter of hours in western Colorado. The cherry trees break dormancy during extended periods of warm weather, reducing their resistance to cold temperatures. Extreme cold following such warm periods can kill the fruit buds and damage the branches, limbs, and the trunk.

Hail damage is also a major production peril in Colorado. Yield losses from hail are spotty, as storms tend to affect relatively small areas. Hail can cause scarring on the fruit and open wounds that serve as an entryway for fungal diseases.

Michigan

Michigan's cherry-growing region extends along its western border with Lake Michigan (Figure 3). There are four distinct growing areas within this region. Three of these--the Northwest, the Southwest, and the Oceana-Mason areas--are major cherry-producing

Figure 3

regions (Ricks, 1994). The fourth, called the Ridge-Belding area, is primarily an apple-growing region that also produces a few cherries. These four areas are characterized by moderately fertile sandy loam soils that are well-suited to cherry production.

Western Michigan’s advantage in the production of tart cherries and other fruits stem, to a great extent, from the moderating effects of Lake Michigan on the local climate. The water slows the rise in air temperatures during the spring, delaying the onset of bloom. During cold spring nights, the same water has a warming effect on air temperatures, which helps avoid frost damage in nearby orchards. The bulk of the cherry acreage is located in a 10-mile wide band adjacent to the lake, where the water has the greatest moderating effects on air temperatures.

The bulk of Michigan’s tart cherry production relies solely on natural rainfall for moisture. Drip irrigation systems, however, are being installed in some of the newer plantings. One contact estimated that 15-20 percent of the tart cherry acreage in northwest Michigan is irrigated (Nugent). Another contact judged that up to one-half of the tart cherry acreage located in central Michigan benefits from drip irrigation (Danilovich).

Late spring frost occurring in the bloom and pre-bloom periods is the most damaging production peril affecting Michigan tart cherries. Such frosts can virtually destroy the entire crop in affected areas. In 1991, for example, a late frost reduced the harvest in southwest Michigan from an expected 2 million pounds to only 140,000 pounds (Nugent). Tart cherries in the more northern areas were spared that year because they bloom several days later than the cherries in southern Michigan, and the fruit buds were not yet at the vulnerable stage when the freeze occurred.

Orchards in northwest Michigan reportedly are less likely to suffer from widespread freeze damage than those in southwest Michigan. Trees in northwest Michigan develop 7-10 day later than in the southern area, and are not yet in their critical bloom period when freezes damage cherries in southern Michigan.

Wind damage reportedly is the second most serious production peril affecting tart cherries. High winds can scar the cherries as they rub against the branches and leaves. Fruit scars remain visible in the processed product, making the damaged cherries undesirable to processors. Scarred cherries also are more susceptible to brown rot infection than uninjured fruit.

A large proportion of Michigan’s tart cherries are produced on non-irrigated land where the trees are susceptible to drought. Dry conditions cause stunted growth in young trees, which may require several years to overcome. Drought conditions during late summer may weaken some trees to the extent that they die during extremely cold winters.

Droughts are unlikely, however, to cause a tart cherry crop failure in Michigan. Excessively dry weather during May and June can diminish fruit size, resulting in moderate yield losses. But, droughts usually are most severe during July, August, and September, after the cherries are harvested. One contact estimated that losses due to drought would not likely exceed 10 percent of the normal yield (Nugent).

Production is more variable in southwest Michigan than in the central and northern areas, due to the more frequent occurrences of frost damage in the southwest and the alternate bearing tendency of cherry trees (Table 9). Frosts can virtually wipe-out the cherry crop in southwest Michigan, as happened in 1976 and 1991, and, at the same time, have little or no effect on northwest Michigan.

Yield variability in the southwest area tends to be exacerbated by the cherry trees' tendency to produce a bountiful crop following small- and moderate-sized crops. When trees bear a light crop, such as may happen following severe frost, they tend to form extra fruit buds and develop abundant energy reserves during the summer, resulting in a bumper crop the subsequent year. The extra-large southwest Michigan crops in 1987 and 1992 both followed seasons with small crops.

Northwest Michigan rarely experiences a total crop failure. Its smallest crop in the past 20 years occurred in 1981 when an unusual storm, accompanied by extreme cold and high winds, froze the fruit buds. Most late spring freezes occur on clear, calm nights when the area is engulfed by a high pressure system and are less severe than the 1981 storm.

New York

New York's tart cherries are located adjacent to Lake Ontario in Niagara, Orleans, Monroe, and Wayne counties in western New York (Figure 4). These four counties accounted for 97 percent of New York's production in 1992. Lake Ontario moderates the climate in these counties, reducing the chances of yield loss due to frosts and freezes during the critical bloom period.

An estimated 5-10 percent of New York's tart cherries are irrigated, depending on moisture conditions. A higher proportion of the cherry acreage is irrigated during dry seasons than during

Table 9

Figure 4

wet years. Growers primarily use portable irrigation systems to supplement natural rainfall as needed.

Although harvesting may begin as early as July 10, the most active harvesting extends from about July 15 through the first of August. Virtually all of New York’s production is mechanically harvested. Production averaged 26 million pounds annually from 1991-95.

The most serious production peril affecting New York cherry growers is frost during the bloom period (Silsby). Being in the more humid eastern part of the country, leaf spot and brown rot also are a constant threat in New York orchards, especially during periods of extended wet weather. Leaf spot can develop rapidly during wet spells, causing early defoliation and weakening the trees. Hail and “wind whip” are other perils for which tart cherry producers in New York would likely seek crop insurance.

The New York Cherry Growers Association promotes the interests of sweet and tart cherry producers in New York. Mike Durando is president of this organization.

Oregon

Although Oregon produced only 1.6 million pounds of tart cherries in 1995, the state's production averaged 7.1 million pounds over the 1990-94 period. The value of the Oregon crop averaged $1.4 million between 1990 and 1994, ranging from $0.4 million to $2.4 million. Oregon accounted for about 2.6 percent of U.S. tart cherry output over this period.

Oregon’s tart cherries are located in the Willamette Valley in western Oregon. The largest concentration of trees is located in central Polk and Yamhill counties, but cherry orchards may be found throughout the length of the valley. The Willamette Valley has a climate adapted to the production of most deciduous fruits and nuts, including tart cherries.

In addition to tart cherries, producers in the Valley also grow sweet cherries, plums, prunes, and hazelnuts. The production of sweet cherries, plums, and prunes is complementary with tart cherries in that the same harvesting equipment is used for all three crops, thereby extending the utilization of this fixed investment. Some tart cherry producers also produce field crops such as grass seed, but most specialize in tree fruits and nuts (Olsen).

As in Michigan, *Montmorency* is the standard variety in Oregon. Growers are trying a number of other varieties on a trial basis, but none accounts for a notable amount of production at this time. Virtually all of Oregon's production is sold for canning and freezing.

Tart cherries are grown on a variety of soil types and terrains in Oregon. Orchards on the valley floor have relatively flat topography and are produced in loamy soils with good water-holding capacity. Orchards in elevated areas tend to have sloping topography, which provides more frost protection than on the valley floor. The soils in the more elevated orchards, however, tend to be less productive than in the valley floor, being either too heavy or too draughty for good orchard sites.

The most serious production peril in Oregon is extended cold, wet weather that prevents insect activity during the critical bloom period. Such conditions have dominated the weather during the bloom period in three of the last five seasons, resulting in low yields due to poor pollination.

Extended wet weather also increases the likelihood of serious disease problems causing crop losses. The most destructive cherry disease is brown rot blossom blight, which can “explode” in the orchard during the blossom period if growers are unable to apply and keep fungicides on the blossoms. The Oregon Extension Service recommends three different applications of fungicide sprays targeted to brown rot during the bloom period.

Occasionally, tart cherries are damaged by late spring frosts in Oregon. But, this peril does not appear to be as much of a threat in Oregon as it does in Michigan.

Hail occasionally damages tart cherries in Oregon. Oregon's orchards are located west of the Cascade Mountain range, where hail occurs less frequently than in the central and eastern United States.

At times, tart cherries in Oregon are damaged by high winds, which can cause scarring of the fruit. Winds usually are not strong enough, however, to damage the trees.

Pennsylvania

In Pennsylvania, tart cherry production is concentrated in Adams and Franklin counties, in the south central part of the state. Orchards in this area are located on rolling or hilly terrain at elevations of 700-1,300 feet above sea level. The hilly terrain promotes good air drainage and a measure of frost protection. Very few, if any, of Pennsylvania’s tart cherries are irrigated. Tart cherry producers in Pennsylvania also produce other fruits, mostly apples and peaches. All of the state's cherries are processed by one cooperatively-owned processor.

Most of Pennsylvania’s cherry growers are represented by the Adams County Fruit Growers Association. Lynn Kime is the president of this grower group.

The perils for which Pennsylvania growers are most likely to want to purchase crop insurance include spring frosts, extended rainy periods at harvest-time, and hail damage. Despite the protection provided by superior air drainage in their orchard sites, late spring frosts are the most severe hazard faced by Pennsylvania's growers (Kleiner).

Extended periods of wet weather at harvest-time lower fruit quality and can cause uncontrollable brown rot outbreaks. Hail storms also are a serious hazard in Pennsylvania, and can virtually "wipe out" the crop for individual orchards lying in the path of a storm.

A number of other production perils, such as drought, high winds, birds, rodents, and insects can damage tart cherries in Pennsylvania. Yield losses to these perils, however, usually amount to a small percentage of the crop and are not likely to be a prime reason for which growers would purchase crop insurance.

Utah

Tart cherries in Utah are located in the middle and northwestern parts of the state, in regions adjacent to the Great Salt Lake and Utah Lake. These bodies of water help protect against frost damage when the trees are in bloom. Box Elder, Utah, and Weber counties produced 97 percent of the state's tart cherry output in 1992.

A major production peril faced by Utah producers is the western cherry fruit fly (Reeve). Fruit fly maggots infect the cherries, causing them to become discolored and unsuitable for consumption. These insects are controlled by insecticide sprays. Other major perils include freezes and hail damage. The last short crop occurred in 1991 and was the result of a late spring freeze.
Due to the dry climate, Utah producers experience few problems with leaf spot, brown rot, and other fungal diseases.

All of the Utah tart cherry crop is irrigated. The majority of producers have permanent sprinkler systems installed in their orchards.

Utah's tart cherry growers are highly diversified, with tart cherries generally accounting for only a portion of total farm production. Apples and peaches are the two most common fruits in addition to cherries.

Tart cherries in Utah are harvested between the middle of July through the second week in August. The cherries are processed at a central location in Box Elder county. At this time, Utah producers have no formal growers organization.

Washington

Washington produced 11.6 million pounds of tart cherries in 1995, having an estimated farm value of $1.4 million. These estimates are down from 17 million pounds and $3.0 million in 1993. The Census of Agriculture reported 12.6 million pounds of tart cherry production for Washington in 1992 (Appendix table 1).

Washington’s production is concentrated in the Columbia River Basin of south central Washington, in Grant, Adams, and Franklin counties. Despite high day-time temperatures, tart cherries reportedly grow well in the Columbia Basin. A typical yield is 8 tons of cherries per acre (Watson). Although the Census of Agriculture reported 106 farms harvesting tart cherries in 1992, five or six producers reportedly account for the bulk of the output (Watson).

Frost is the major production peril affecting tart cherries in Washington. Cherries bloom about the same time as apples in the Colombia Basin, and both crops can be damaged by late frosts, reducing the season's yield.

Although all tart cherries are irrigated in the Colombia Basin, drought becomes a production peril if the irrigation district does not have enough water to supply its members' needs. Water is allocated to districts according to “junior” rights and “senior” rights. During periods of water shortages, water is withheld first from irrigation districts with junior rights.

Unlike Michigan and other areas with more humid climates, brown rot and cherry leaf spot are not considered a serious production hazard in Washington.

Wisconsin

Wisconsin produced 7.7 million pounds of tart cherries in 1995, 2 percent of U.S. production (U.S. Department of Agriculture). The value of the Wisconsin crop ranged from $292,000 in 1995 to $3.7 million in 1991.

Virtually all of Wisconsin’s tart cherries are grown in Door County, which is surrounded on three side by Lake Michigan. Because of the lake effect, air temperatures rise slowly in the spring, delaying flower bud development. In addition, the water warms air temperatures on cold nights, providing further protection against late spring frosts. Because of delayed bud development, Door County cherries usually bloom after the danger of frost has past and the fruit is not damaged by late freezes. The lake also moderates summer-time temperatures, which favors tart cherry production.

The Census of Agriculture reported 169 Wisconsin farms harvesting tart cherries in 1992. Reportedly, there are a small number of farms with more than 100 acres and numerous farms with fewer than 100 acres in tart cherries (Weidman). A number of farms have 40-50 acres.

Tart cherry growers in Wisconsin are generally not diversified beyond fruit production. The larger producers tend to specialize in tart cherries, and also produce some apples. On the smaller farms, apples likely account for a larger share of the farms' acreage than cherries.

Tart cherries in Door County tend to be planted on shallow, sandy loam soils that are subject to drying out quickly. One-third of the acreage is estimated to be irrigated with drip irrigation systems (Weidman). Most of the irrigated acreage is owned by the larger producers.

Montmorency is the main variety grown in Wisconsin. Growers are experimenting with a number of other cultivars, but none of these accounts for notable acreage. Canning and freezing are the major uses for Wisconsin cherries. However, at least one processor is drying cherries, and a portion of the crop is sold fresh at fruit stands and through pick-your-own operations.

The most serious production perils include winter injury due to extreme cold, and weather conditions that lead to serious disease problems. Extremely low temperatures destroyed an estimated 35 percent of the flower buds during the 1995/96 winter (Weidman). Although cherries can sustain some flower bud damage and still produce a good crop, extensive damage reduces fruit production. In the most extreme cases, it is estimated that flower bud damage would reduce fruit production by up to a third in Wisconsin.

Excessive rain that prevents growers from applying fungicides and that wash fungicides from the fruit creates the potential for the rapid development of brown rot and cherry leaf spot. Brown rot can develop quickly on unprotected fruit and result in the loss of virtually the entire crop. Leaf spot damage usually manifests itself in the form of weakened trees, which are more susceptible to flower bud damage and winterkill than are healthy trees.

Hail and drought also are notable production perils in Wisconsin. The sandy soils on which cherries are produced dry out quickly, and spring droughts can reduce fruit size and lower the tonnage harvested. Summer droughts weaken cherry trees, making them more susceptible to winter damage.

Frost reportedly is not a serious peril in Wisconsin (Weidman). The protective effect of the surrounding lake delays the bloom period until after the danger of late frost has passed.

Ad Hoc Disaster Assistance for Tart Cherries

Ad hoc disaster assistance legislation was made available for losses of commercially-grown crops in each of the years 1988-94. Ad hoc payments provide an indication of high-loss areas during that period, and may indicate states and counties that would face relatively high risk under a potential Office of Risk Management (ORM) tart cherry policy. These data may also suggest the areas where the demand for a tart cherry crop insurance policy would be relatively high.

Under the 1988-94 legislation, payments were made to producers of participating program crops, nonparticipating program crops, sugar, tobacco, peanuts, soybeans, sunflowers, nonprogram crops, ornamentals, and at times, aquaculture. Producers without crop insurance--the case for tart cherries--were eligible for payments for losses greater than 40 percent of expected production.

Ad hoc disaster data for cherries cannot be divided into separate categories for sweet cherries and tart cherries. As a result, the following discussion relates to disaster payments for all cherries between 1988 and 1994, regardless of the type of cherry.
In the aggregate, payments for cherry losses (all types) totalled over $33.7 million between 1988-94. Among the major tart-cherry producing counties, Oceana County, Michigan received the largest volume of payments for cherry (all types) losses, at $2.2 million over the 1988-94 period (Table 10).

Other counties receiving large disaster assistance payments for cherry losses include: Berrien County, Michigan ($1.3 million); Leelanau County, Michigan ($1.1 million); and Manistee County, Michigan ($1.1 million). The largest payments received by any county outside of Michigan were destined for Utah County, Utah, at $832,000.

Table 10

Insurance Implementation Issues

Demand for Insurance

The greatest potential demand for tart cherry insurance likely exists in Michigan. Michigan has the largest acreage planted to tart cherries of any state in the U.S., and has a relatively high probability of yield loss due to late spring-time frosts, especially in the central and southern areas of the state.

Although growers in northern Michigan are less likely to incur yield losses due to frost than those growers in the more southern areas, northern growers may also choose to purchase insurance. The reason is that they tend to be specialized in tart cherries and a yield loss represents a large proportion of their annual income.

In central and southern Michigan, on the other hand, growers are more diversified and a crop failure among cherries is likely to represent less of a financial loss than in the North. For this reason, northern Michigan’s growers may also feel a need for insurance as a risk management tool.

Growers in other states would also likely have an interest in tart cherry insurance. This is particularly true of growers in areas subject to crop loss due to late spring-time frosts.

Adverse Selection

Several opportunities for adverse selection may arise in insuring tart cherries. The greatest potential likely relates to an orchard site’s chances of loss due to late spring-time frost. Some orchards in a given area are prone to damage from late spring-time frost, while others are notably resistant to frost damage. In Michigan, for example, orchards within 10 miles of Lake Michigan are less prone to loss due to frost than sites further from the lake.

In addition, orchards in northern Michigan are less prone to loss than those in central and southern Michigan. And orchards on hilltops are less likely to suffer losses than are those at lower elevations or ones in “cold pockets.” Growers in frost-prone orchards may expect to collect higher indemnities, and would therefore be more likely to purchase insurance, than growers with orchards on more frost-resistant sites.

Another potential for adverse selection may arise in a producer's choice of cherry variety. For example, the new “*Balatan*” variety blooms later in the spring than does the *Montmorency* variety.

Because of its late bloom, *Balatan* cherries tends to escape damage from late spring-time frosts. Therefore, growers with large acreage of *Balatan* may be less inclined to buy insurance than would *Montmorency* producers.

Reference Prices

The Office of Risk Management provides reference prices (price elections) for insured crops, which become the basis for calculating indemnity payments. Insured growers select a price election when they purchase insurance. A five-season average or an Olympic average of USDA's grower prices for processing cherries would serve as a suitable basis for setting price elections.

Estimating "Appraised Production"

Estimating "appraised production" (harvestable but unharvested yield) may be an issue with insuring tart cherries when part of the yield is abandoned in the field. A procedure comparable to that used by the National Agricultural Statistics Service for their objective yield surveys of fruit crops would be appropriate for estimating appraised production. This procedure involves picking and weighing the marketable fruit from a sample of plots (limbs) and expanding the sample yields to a per-acre basis.

Moral Hazard

A substantial portion of tart cherry production is non-utilized in years with low prices because growers minimize losses by abandoning their crop. For example, the U.S. farm price for tart cherries fell to 6 cents a pound in 1995, down from 16 cents the previous year and a 10-year average of 18 cents. Because of the low price, twenty-one percent of the 1995 crop was non-utilized production.

Moral hazard occurs when a grower intentionally (either through neglect or overt actions) contributes to causing a yield loss. Because a substantial amount of production is abandoned in low-price years, moral hazard could become a contentious problem with insuring cherries. Growers could receive a higher return from collecting insurance due to a crop failure than from selling their crop.

In Michigan, an incentive for moral hazard arises when cherry prices fall below about 12 cents a pound, given the assumptions below. At that price, growers would receive the same gross return from insurance on a complete crop failure (4,155 pounds * 0.18 cents per pound = $747.86 per acre return) as they would from harvesting and marketing their crop (6,392 pounds * 0.117 = $747.86 per acre return), as shown in the example. These calculations do not take into account the expenses for harvesting and marketing associated with producing a full crop, which would increase the break-even price somewhat. The amount of the increase would depend on the individual producer's costs.

Example

APH yield (Michigan average)	6,392 pounds
65% yield guarantee	4,155 pounds
Price election (10-year avg price)	18 cents
Insurance liability	$747.86
Price needed to equal insurance return	11.7 cents

A "Dollar Amount" or Revenue Insurance Policy

Michigan’s production dominates the tart cherry market. When Michigan has a short crop, growers in all states receive a high price for their cherries, but when Michigan has a large crop, growers everywhere receive a low price. Because of the marked inverse relationship between Michigan’s production and producer prices in all states, farmers with low yields may or may not experience lower revenues. In a similar vein, tart cherry returns may be quite low during some years when yields are relatively high because of low market prices.

Because low yields do not always translate into low returns, a "dollar amount" plan (based on the concept of revenue insurance) may be appropriate in insuring tart cherries. With such a provision, growers would need to demonstrate a revenue loss in order to collect an insurance indemnity. Such a plan may reduce the cost of insurance to producers and still provide income protection due to yield losses.

Individual Yield Data

Growers are likely to have adequate records to determine their average production history (APH) based on acreage of bearing trees and the amount of utilized production delivered to processors. Such an APH is likely to understate the actual production for some growers, however, because part of their crop may not have been harvested in some years.

This is because utilized production counts only those cherries that were actually harvested and processed. During seasons with very low prices, growers may not harvest cherries or they may harvest only a portion of their production. The reason for this is that the value of the cherries falls so low that it becomes unprofitable to harvest and process the fruit.

Some adjustment may be needed to account for utilization in order to derive an APH yield based on total production. One approach to making such an adjustment would be to draw on information assembled in the course of administering the proposed Tart Cherry Marketing Order. The recently-passed marketing order would provide for the Marketing Order Administrative Board to issue “diversion certificates” to growers for unharvested cherries as proof that those cherries had not entered the food channel. The sum of marketed cherries plus the amount on the diversion certificate may provide a suitable measure for calculating APH.

Insuring Trees

Several extension specialists mentioned that severe cold frequently results in winterkill among tart cherry trees. Because of the financial loss associated with winterkill, growers may have an interest in insuring their trees.

Insuring tart cherry trees could be fraught with adverse selection and moral hazard problems, however, as losses usually are associated with lax management. Healthy trees can normally withstand the coldest winters in the major cherry-producing areas. Winterkill occurs when the trees enter the winter in a weakened condition due to disease, drought, excessive production, or a combination of these.

One frequently cited cause of weakened trees is early defoliation due to severe outbreaks of leaf spot disease (Nugent, Longstroth, Danilovich, Kleiner). Reportedly, as a cost savings, growers sometimes neglect to apply adequate fungicide sprays to control leaf spot following the cherry harvest. As a result, leaf spot proliferates, causing defoliation and leaving the trees with low energy stores. Such trees are more likely to die during a severe winter than if they had entered the winter with abundant energy reserves.

Trees planted on sites with heavy, wet soils also are more prone to winterkill than trees planted on lighter, well-drained soils. Trees on wet soils are more likely to develop root diseases than if they were planted on well-drained sites. As with trees weakened by leaf spot, those weakened by root diseases also are more likely to die during severe winters than are healthy trees. Extreme drought during the summer also weakens trees, increasing their susceptibility to winterkill.

References

Christensen, Rondo A., Lynn H. Davis, and Stuart H. Richards. *Enterprise Budgets for Farm and Ranch Planning in Utah*. Utah State University Agricultural Experiment Station. Research Report No. 5. April 1973.

Danilovich, Mira. Extension Horticulturist. Michigan State University. Mason and Oceana Counties, Michigan. Personal communication. July 1996.

Fogle, H. W., L. C. Cochran, and H. L. Keil. *Growing Sour Cherries*. Agriculture Handbook No. 451. Agricultural Research Service, USDA. March 1974.

Gaus, Alvan. Extension Fruit Specialist. Hodgekiss, Colorado. Personal communication. August 1996.

Johnston, C. Richard. Managing Director. Cherry Marketing Institute. Testimony presented at public hearing in Grand Rapids, Michigan on December 15-17, 1993 concerning a proposed marketing agreement and order for tart cherries.

Kelsey, Myron P., and Glenn Kole, James Nugent, and James Bardenhagen. *Cost of Producing Tart Cherries in Northwestern Michigan*. Michigan State University Cooperative Extension Service. Extension Bulletin No. E-1108. July 1996.

Kleiner, William. Extension Fruit Specialist. Adams County, Pennsylvania. Personal communication. June 1996.

Longstroth, Mark. Extension Fruit Specialist. Michigan State University. Van Buren County, Michigan. Personal communication. July 1996.

Michigan Agricultural Statistics Service. *Michigan Agricultural Statistics.* Various issues.

Nugent, James. Extension Horticulturist. Michigan State University. Personal communication. June 1996.

Olsen, Jeff. Area Extension Horticulturist. Yamhill and Polk Counties, Oregon. Personal communication. June 1996.

Reeve, Thomas. Extension Agent. Box Elder County, Utah. Personal communication. July 1996.

Ricks, Donald J. *The Michigan-U.S. Tart and Sweet Cherry Industries--Plantings, Trends and Economic Situation*. Department of Agricultural Economics. Michigan State University. Staff Paper No. 94-70. February 1994.

Ricks, Donald J. and Larry Hamm. *The U.S. Tart Cherry Subsector*. Department of Agricultural Economics. Michigan State University. Staff Paper No. 85-60. May 1985.

Ricks, Donald J. and W. Compton Chase-Lansdale. *The Tart Cherry Subsector of U.S. Agriculture: a review of Organization and Performance*. North Central Regional Research Publication No. 278. University of Wisconsin-Madison. July 1982.

Silsby, Kenneth. Cooperative Extension Agent. Wayne County, New York. Personal communication. July 1996.

U.S. Department of Agriculture. Agricultural Marketing Service. *Tart Cherries Grown in the States of Michigan, New York, Pennsylvania, Oregon, Utah, Washington, and Wisconsin: Secretary's Decision and Referendum Order on the Proposed Marketing Agreement and Order*. Proposed Rule. Federal Register. May 29, 1996. Volume 61, Number 104. pp. 26955-79.

U.S. Department of Agriculture. Agricultural Marketing Service. *Tart Cherry Industry Approves Federal Marketing Order.* Press Release No. AMS-245-96. July 31, 1996.

U.S. Department of Agriculture. Farm Service Agency. Ad Hoc Disaster Assistance Data Files, 1988-94. Complied by the General Accounting Office.

U.S. Department of Agriculture. National Agricultural Statistics Service. *Noncitrus Summary*. Various issues. Washington, D.C.

U.S. Department of Commerce. Bureau of the Census. *Census of Agriculture, 1992*.

U.S. Department of Commerce. Bureau of the Census. *Census of Agriculture, 1987*. Special tabulation for USDA, ERS of farms producing tart cherries.

Watson, Jack. Extension Horticulturist. Washington State University. Agricultural Experiment Station. Prossor, Washington. Personal communication. July 1996.

Weidman, Richard. Extension Horticulturist. University of Wisconsin. Personal communication. June 1996.

Tart Cherry Contacts

Michigan:

Randy Harmson, General Manager
Michigan Agricultural Cooperative Marketing Association,
Tart Cherry Division
P.O. Box 30960
Lansing, Michigan 48909
(515) 323-7000

Phillip Korson, General Manager
Cherry Marketing Institute, Inc.
2220 University Park Drive
Okemos, Michigan 48864
(517) 347-0010

James Nugent, Extension Agent
6686 Center Highway
Traverse City, Michigan 49684
(616) 946-1510

Pennsylvania:

Lynn Kime, President
Adams County Fruit Growers Association
724 Gardners Station Road
Gardners, Pennsylvania 17324-9713
(717) 677-6225

New York:

Mike Durando, President
New York Cherry Growers Association
7645 Main Street
P.O. Box 350
Fischers, New York 14453
(716) 924-0340

Utah:

Thomas Reeve, Extension Agent
Box Elder County, Utah
(801) 257-5810

Appendix A

Cost of Production Budgets for Tart Cherries

Northwestern Michigan
Utah

Table 1--U.S. tart cherries: value of production, selected states, 1985-95

States	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	1,000 dollars										
Colorado	390	359	81	201	50	186	663	547	224	390	414
Michigan	47,145	32,751	16,890	31,266	25,385	29,520	52,890	41,100	24,610	35,636	13,448
New York	5,764	2,835	2,318	4,835	3,396	2,765	11,480	4,015	1,570	2,934	1,611
Oregon	1,560	960	340	780	2,252	968	2,214	2,389	426	1,185	170
Pennsylvania	1,608	3,040	779	2,301	1,027	931	5,538	1,646	1,951	2,385	1,012
Utah	4,832	3,533	1,654	1,826	2,716	1,906	11,583	4,200	960	2,266	624
Washington	---	---	---	---	---	---	---	---	2,973	2,457	1,384
Wisconsin	1,549	788	295	973	522	409	3,714	1,333	430	1,126	292
United States	62,848	44,266	22,357	42,182	35,348	36,685	88,082	55,230	33,144	48,379	18,955

Source: USDA, National Agricultural Statistics Service.

Table 2--U.S. tart cherries: supply and utilization, 1979/91 to 1995/96[1]

Season	Supply: Production/ Pack[2]	Imports	Beginning stocks	Total supply	Utilization: Ending Stocks	Exports	Total	Consumption Per capita
	--Million pounds--							Pounds
Canned:								
1990/91	67.5	0.5	N.A.	68.0	N.A.	7.1	60.9	0.24
1991/92	58.0	0.3	N.A.	58.3	N.A.	7.6	50.7	0.20
1992/93	76.3	0.8	N.A.	77.1	N.A.	11.0	66.0	0.26
1993/94	88.7	0.6	N.A.	89.3	N.A.	11.0	78.3	0.30
1994/95	101.5	0.3	N.A.	101.8	N.A.	12.5	89.3	0.34
1995/96	92.5	0.3	N.A.	93.0	N.A.	16.6	76.4	0.29
Frozen:								
1992/93	192.8	N.A.	58.0	250.8	127.8	N.A.	123.0	0.48
1993/94	139.9	N.A.	127.8	267.7	110.1	N.A.	157.5	0.61
1994/95	156.5	N.A.	110.1	266.6	122.8	N.A.	143.8	0.55
1995/96	164.7	0.1	122.8	287.6	130.6	16.9	140.1	0.53

N.A. = Not available.

[1] Product weight.
[2] Canned production estimated as NASS canned utilization converted to product

weight.

Source: USDA, Economic Research Service.

Table 3--Tart Cherries: Total production and utilization, selected states, 1985-95 1/

States	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Million pounds										
Colorado	1.7	.9	2.5	1.3	.5	1.0	1.6	1.5	1.6	1.5	1.2
Utilized	1.7	.9	.8	.8	.4	.9	1.6	1.5	.9	1.1	1.0
Michigan	220.0	170.0	265.0	180.0	180.0	160.0	110.0	245.0	270.0	210.0	310.0
Utilized	215.0	165.0	225.0	180.0	170.0	160.0	110.0	235.0	215.0	210.0	250.0
Fresh	5.0	3.0	5.0	3.0	3.0	3.0	1.0	5.0	3.0	2.0	1.0
Processed	210.0	162.0	220.0	177.0	167.0	157.0	109.0	230.0	212.0	208.0	249.0
New York	22.5	13.0	35.0	22.0	31.0	16.5	25.5	31.0	15.7	26.0	32.0
Utilized	22.5	12.3	24.4	21.5	22.5	13.3	25.5	22.1	15.2	23.7	20.0
Fresh	.5	.2	2.0	.3	.5	0.3	0.2	0.1	0.1	0.1	.2
Processed	22.0	12.1	22.4	21.2	22.0	13.0	25.3	22.0	15.1	23.6	19.8
Oregon	6.5	6.0	8.0	4.0	15.0	7.5	7.5	9.5	3.0	8.0	1.6
Utilized	6.5	6.0	6.2	4.0	15.0	7.5	7.5	9.5	2.8	7.6	1.5
Fresh	.6	.4	.6	0.5	2.0	0.9	1.5	1.9	0.7	--	--
Processed	5.9	5.6	5.6	3.5	13.0	6.6	6.0	7.6	2.1	--	--
Pennsylvania	6.0	12.0	5.0	9.0	6.0	3.5	11.5	6.0	11.5	9.0	9.5
Utilized	6.0	12.0	4.3	9.0	5.7	3.3	11.5	6.0	10.0	9.0	9.5
Fresh	.6	1.0	.8	0.8	0.7	--	--	--	--	--	--
Processed	5.4	11.0	3.5	8.2	5.0	--	--	--	--	--	--
Utah	21.0	18.5	29.0	11.0	24.0	15.5	26.0	33.0	15.0	26.5	22.0
Utilized	21.0	18.5	20.0	9.6	22.5	13.5	26.0	30.0	7.5	22.0	13.0

Fresh	.2	.6	.2	0.1	0.1	0.1	0.1	0.3	0.1	--	--
Processed	20.8	17.9	19.8	9.5	22.4	13.4	25.9	29.7	7.4	22.0	13.0
Washington	---	---	---	---	---	---	---	---	17.0	14.0	11.6
Utilized	---	---	---	---	---	---	---	---	17.0	14.0	11.6
Wisconsin	8.5	3.7	14.0	8.9	7.6	4.8	7.8	9.1	6.6	9.2	7.7
Utilized	7.5	3.7	4.9	8.6	6.9	4.4	7.6	8.9	4.4	8.9	4.6
Fresh	.6	.2	.3	0.3	0.4	0.1	0.1	0.4	0.2	0.2	.2
Processed	6.9	3.5	4.6	8.3	6.5	4.3	7.5	8.5	4.2	8.7	4.4
United States	286.2	224.1	358.5	236.2	264.1	208.8	189.9	335.1	340.4	304.2	395.6
Utilized	280.2	218.4	285.6	233.5	243.0	202.9	189.7	313.0	273.6	296.3	311.2
Fresh	7.6	5.5	9.0	5.0	6.7	5.0	3.7	8.8	5.3	3.6	2.8
Processed	272.6	212.9	276.6	228.5	236.3	197.9	186.0	304.2	268.3	292.7	308.4

1/ Total production includes utilized production plus production not harvested and production harvested
but not sold due to economic conditions.

-- = indicates data are not available.

Source: USDA, National Agricultural Statistics Service.

Table 4--U.S. tart cherries: bearing acreage, selected states, 1985-95

States	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Acres										
Michigan	33,300	36,200	34,000	33,300	33,300	32,900	31,600	33,900	33,000	32,000	30,000

New York	4,800	5,100	5,300	5,200	5,000	4,700	4,000	4,000	4,000	4,000	4,000
Oregon	1,600	1,700	1,800	1,800	2,000	2,100	2,100	1,700	1,700	1,600	1,600
Pennsylvania	1,600	1,600	1,600	1,600	1,800	1,800	1,800	1,600	1,500	1,500	1,500
Wisconsin	3,430	3,430	2,770	2,810	2,900	3,000	3,100	3,100	3,100	3,100	3,100
Other	3,700	3,800	4,530	4,530	4,290	4,290	4,290	4,180	5,430	5,425	5,425
United States	48,430	51,830	50,000	49,240	49,290	48,790	46,890	48,480	48,730	47,625	45,625

Source: USDA, National Agricultural Statistics Service.

Table 5--U.S. tart cherries: average yield per acre, 1/ selected states, 1985-95

States	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Pounds/acre										
Michigan	6,610	4,700	7,790	5,410	5,410	4,860	3,480	7,230	8,180	6,560	10,300
New York	4,690	2,550	6,600	4,230	6,200	3,510	6,380	7,750	3,930	6,500	8,000
Oregon	4,060	3,530	4,440	2,220	7,500	3,570	3,570	5,590	1,760	5,000	1,000
Pennsylvania	3,750	7,500	3,130	5,630	3,330	1,940	6,390	3,750	7,670	6,000	6,330
Wisconsin	2,480	1,080	5,050	3,170	2,620	1,600	2,520	2,940	2,130	2,970	2,480
United States	5,910	4,320	7,170	4,800	5,360	4,280	4,050	6,910	6,990	6,390	8,670

1/ Yield is based on total production and bearing acreage.

Source: USDA, National Agricultural Statistics Service.

Table 6--U.S. tart cherries: prices received by growers, selected states, 1985-95

States	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Cents/pound										
Colorado	22.9	39.9	10.1	25.1	12.5	20.7	41.4	36.5	24.9	35.5	41.4
Michigan	21.9	19.8	5.5	18.3	14.9	18.5	48.1	17.5	11.4	17.0	5.4
Fresh	31.5	27.9	5.3	45.1	39.0	42.0	57.0	40.0	43.0	45.0	50.0
Processed	21.7	19.7	12.2	17.8	14.5	18.0	48.0	17.0	11.0	16.7	5.2
New York	25.6	23.0	9.5	22.5	15.1	20.8	45.0	18.2	10.3	12.4	8.1
Fresh	44.0	50.0	6.6	43.0	50.0	55.0	60.0	55.0	60.0	55.0	63.0
Processed	25.2	22.6	42.0	22.2	14.3	20.0	44.9	18.0	10.0	12.2	7.5
Oregon	24.0	16.0	5.5	19.5	15.0	13.2	29.5	25.1	15.2	15.6	11.3
Fresh	24.0	16.0	9.0	30.0	19.0	14.3	35.2	26.5	15.8	24.0	14.9
Processed	24.0	16.0	5.1	18.0	14.4	13.0	28.1	24.8	15.0	15.0	10.0
Pennsylvania	26.8	25.3	16.4	25.6	18.0	28.2	48.2	27.4	18.1	26.5	10.7
Fresh	52.0	51.0	49.0	56.0	49.5	--	--	--	--	--	--
Processed	24.0	23.0	8.9	22.6	13.6	--	--	--	--	--	--
Utah	23.0	19.1	7.2	19.0	12.1	14.1	44.6	14.0	12.8	10.3	4.8
Fresh	24.0	22.0	29.0	21.0	28.0	30.0	32.0	24.0	28.0	--	--
Processed	23.0	19.0	7.0	19.0	12.0	14.0	44.6	13.9	12.6	10.3	4.8

Washington	---	---	---	---	---	---	---	---	17.5	17.6	11.9
Wisconsin	20.7	21.3	6.0	11.3	7.6	7.7	48.9	15.0	9.8	12.7	6.3
Fresh	35.0	42.0	31.0	31.0	33.0	39.0	46.0	40.0	47.0	41.0	36.0
Processed	19.4	20.1	4.4	10.6	6.0	7.0	48.9	13.8	8.0	12.0	5.0
United States	22.4	20.3	6.1	18.7	14.5	18.1	46.4	17.6	12.1	16.3	6.1
Fresh	33.4	32.3	22.9	43.9	34.4	39.2	45.9	38.9	39.9	43.1	43.4
Processed	22.1	20.0	5.6	18.2	14.0	17.5	46.4	17.0	11.6	16.0	5.8

-- = indicates data are not available.

Source: USDA, National Agricultural Statistics Service.

Table 7--U.S. tart cherries: usual bloom and harvesting dates, selected states

State	Usual dates of full bloom	Usual harvesting dates: Begin	Most active	End
Colorado	April 30	July 5	July 20-July 30	Aug. 5
Michigan				
Northwest	May 10-May 25	July 10	July 15-Aug. 10	Aug. 25
West Central	May 5-May 20	July 5	July 10-July 30	Aug. 10
Southwest	May 1-May 10	July 1	July 5-July 20	July 25
New York				
West	May 5-May 20	July 10	July 15-July 30	Aug. 5
Hudson Valley	May 1-May 15	June 25	July 5-July 20	July 30
Oregon	April 10-April 25	July 5	July 10-July 15	July 20
Pennsylvania				
South Central	May 1-May 10	June 25	July 5-July 20	July 25
Northwest	May 5-May 15	July 1	July 10-July 25	Aug. 1
Utah	April 24	July 10	July 15-July 30	Aug. 10
Wisconsin	May 25	July 25	Aug. 1-Aug. 10	Aug. 15

Source: USDA, Statistical Reporting Service.

Table 8--U.S. tart cherries: costs of production

Item	Michigan (1996)	Utah [1] (1972)
	Pounds	
Yield	7,000	16,515
	Dollars per acre	
Cash expenses:		
Preharvest	712	188
Harvest	562	390
Total	1,274	578
Ownership costs[1]	716	68 [2]
Total costs	1,990	646

[1] Annual costs for years 8-20.

[2] Does not include returns on land investment.

Sources: Kelsey and others, 1989; and Christensen and others, 1973.

Table 9--Michigan tart cherry: production, by region, 1976-1994

Season	Northwest	West Central	Southwest	Other	State
	---	---	Million pounds	---	---
1976	56	28	5	1	90
1977	83	46	31	2	162
1978	85	26	15	2	128
1979	53	29	17	1	100
1980	72	37	39	2	150
1981	35	24	28	1	88
1982	137	64	57	2	260
1983	50	12	24	1	87
1984	115	45	48	2	210
1985	105	70	44	1	220
1986	125	25	19	1	170
1987	120	70	73	2	265
1988	110	34	35	1	180
1989	70	40	69	1	180
1990	70	55	34	1	160
1991	85	23	1	1	110
1992	110	75	59	1	245
1993	145	89	35	1	270
1994	100	53	56	1	210
Average	91	44	36	1	173
Standard deviation	30	20	20	*	60
Coefficient of variation[1]	33%	46%	55%	35%	35%

* Less than 0.5.

[1] Standard deviation divided by the average.

Source: Michigan Agricultural Statistics Service.

Table 10--All cherry disaster assistance payments for major tart cherry producing counties

State and County	Total Payments, 1988-94 (thousand dollars)
Michigan:	
Allegan	420
Antrim	495
Benzie	788
Berrien	1,344
Cass	283
Charlevoix	98
Grand Traverse	780
Kent	267
Lake	0
Leelanau	1,129
Manistee	1,128
Mason	986
Muskegon	351
Newaygo	71
Oceana	2,227
Ottawa	132
Van Buren	981
New York:	
Monroe	104
Niagara	112
Orleans	141
Wayne	380
Oregon:	
Lane	59
Linn	450
Marion	319
Polk	571
Washington	71
Yamhill	659
Pennsylvania:	
Adams	28
Franklin	0
Utah:	
Box Elder	282
Utah	832
Weber	31
Washington:	
Adams	135
Franklin	263
Grant	509
Wisconsin:	
Door	490

Source: USDA, Farm Service Agency.

Appendix table 1--Tart cherry production: Major states and counties, 1992

State and major counties	Total Farms	Total Acres	Total Trees	Bearing Age Trees	Harvested Farms	Harvested Pounds
Colorado	128	494	65,807	56,138	65	1,629,112
Michigan	1,265	44,444	4,435,535	3,781,745	1,014	218,394,791
Antrim	52	2,871	293,944	255,079	50	13,690,723
Berrien	160	3,581	324,822	278,624	133	21,435,346
Grand Traverse	153	5,542	511,568	423,500	132	17,253,003
Leelanau	196	9,036	955,073	851,405	178	53,040,910
Mason	47	2,391	223,824	186,630	39	9,879,947
Oceana	134	9,276	958,503	770,827	126	50,386,660
Van Buren	93	3,637	358,651	325,763	81	18,280,923
Other	430	8,110	809,150	689,917	275	34,427,279
New York	302	4,083	378,644	362,581	214	21,857,612
Niagara	31	716	64,734	(N)	27	4,580,971
Orleans	26	370	48,045	(N)	17	2,122,136
Wayne	120	2,684	243,047	231,573	100	13,612,559
Other	125	313	22,818	131,008	70	1,541,946
Oregon	378	2,194	205,013	186,736	213	9,438,812
Lane	57	214	15,620	15,084	35	776,764
Marion	31	163	11,768	9,938	18	972,706
Polk	37	830	83,442	70,983	28	3,264,352
Washington	32	180	19,033	18,644	18	568,659

Yamhill	42	547	52,123	49,412	21	2,786,792
Other	179	260	23,027	22,657	93	1,069,539
Pennsylvania	381	1,576	152,414	135,206	244	5,658,281
Adams	47	1,224	125,921	112,840	39	4,624,634
Other	334	352	26,493	22,366	205	1,033,647
Utah	219	4,505	567,035	523,726	167	32,043,698
Box Elder	62	655	60,088	48,600	53	3,856,585
Utah	96	3,596	475,147	445,832	79	26,442,656
Other	61	254	31,800	29,294	35	1,744,457
Washington	226	1,382	201,173	(N)	106	12,622,575
Wisconsin	245	3,293	327,342	261,312	169	8,571,775
Door	124	3,113	312,269	249,959	108	8,448,005
Other	121	180	15,073	11,353	61	123,770
These states	3,144	61,971	6,332,963	5,307,444	2,192	310,216,656
United States	3,851	62,533	6,370,586	5,492,671	2,472	310,885,756

(N): Indicates not available or not published to avoid disclosure.

Source: U.S. Department of Commerce, 1992.

Appendix table 2--Size distribution of farms producing tart cherries, 1987

State	Farms	Total value of crop sales: $500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number	Percent of farms				
Michigan	1,450	2	13	11	13	62
New York	407	3	27	16	11	43

Oregon	390	1	7	6	4	82
Pennsylvania	510	2	12	7	7	73
Utah	263	1	8	6	6	79
Wisconsin	260	1	3	6	6	84
U.S.	4,198	2	13	9	9	67

Source: U.S. Department of Commerce, 1987.

Figure 1. U.S. Tart Cherries: Total and Utilized Production, 1985-95

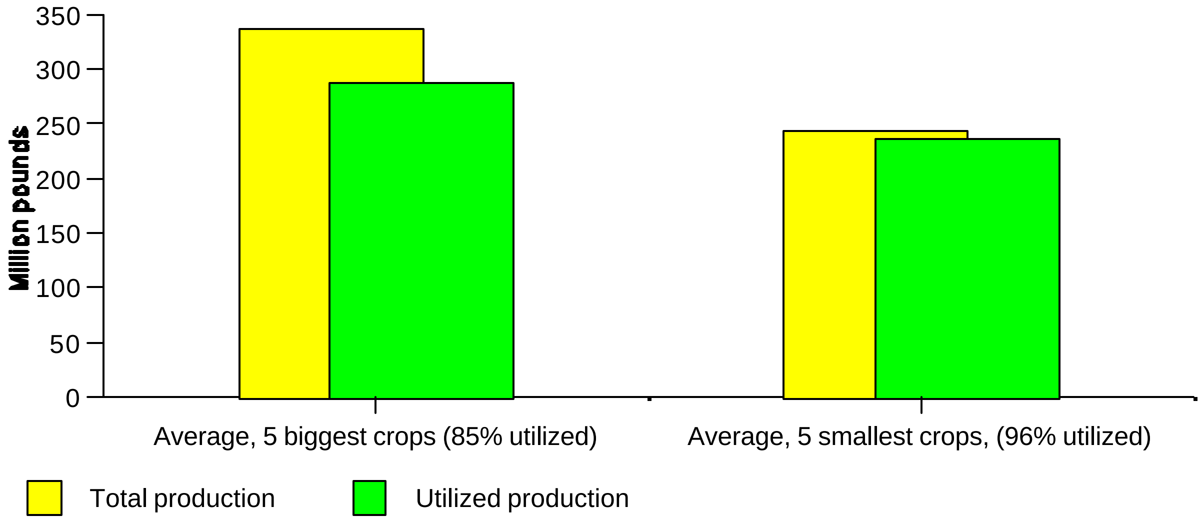

Figure 2. U.S. Tart Cherries: Production and Price

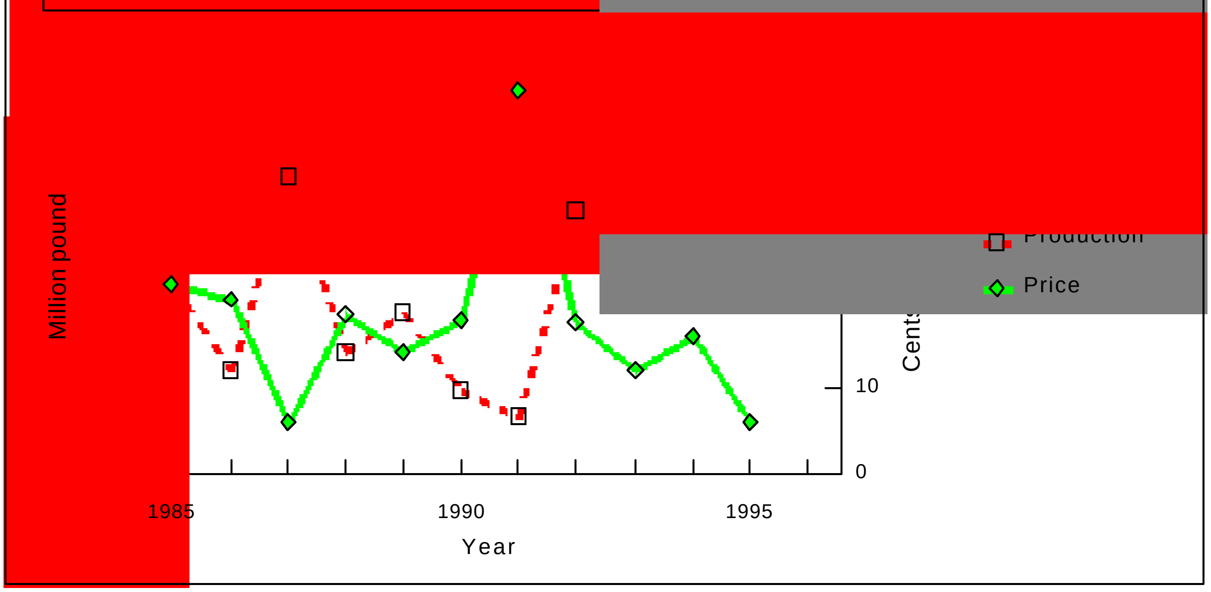

Figure 3. Major tart cherry counties in Michigan

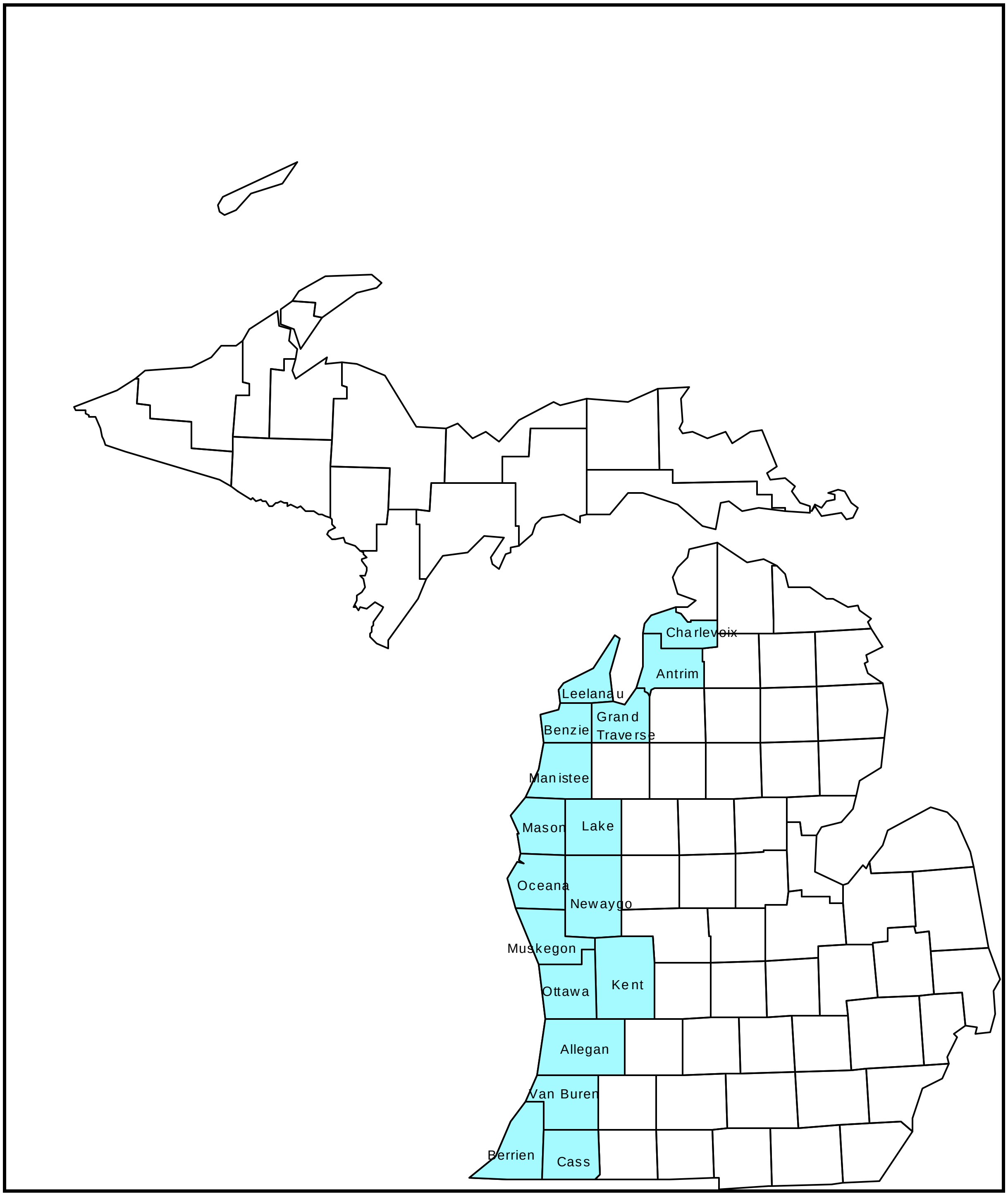

Figure 4. Major tart cherry counties in selected states