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

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Executive Summary

The sweet cherry is a drupe or stone fruit that belongs to the genus *Prunus*, along with almonds, peaches, plums, and apricots. Both sweet and sour (or tart) cherries belong to the same family, *Rosaceae*, but different species; *Avium* is the sweet cherry species and *Cerasus* is the sour species.

Most U.S. sweet cherries are grown in the West. Washington and California supply mainly dark, sweet Bing cherries intended for fresh use, while Oregon and Michigan provide light-colored Royal Ann (Napoleon) cherries for the maraschino process. Overall, there are more than 500 sweet cherry cultivars, but less than 20 are currently commercially important in the United States.

Production of sweet cherries in the nine states reported by USDA (Washington, Oregon, California, Michigan, Pennsylvania, New York, Montana, Idaho, and Utah) has fluctuated during the last 10 years from 430 million pounds in 1987 to only 265 million pounds in 1985. Washington has been the leading producer, with an average 154.5 million pounds in 1991-94, followed by Oregon (84 million pounds), California (69 million pounds), and Michigan (47 million pounds). Acreage has risen since the mid-1980's in California and Washington, but has declined in Michigan and Oregon.

About half of the U.S. sweet cherry crop is typically used fresh and half is processed. Cherries may be processed that cannot be effectively marketed during the short harvest season, or that are undersized and/or blemished and do not meet fresh-grade standards. About 70 percent of the sweet cherries processed in 1991-94 were brined, about 10 percent were canned, and nearly 20 percent were frozen, dried, or used for juice. Brining is the first step in the maraschino process.

Michigan and Oregon accounted for 64 percent of U.S. brined cherries during 1991-94. Most premium-quality handpicked cherries with the stems attached (used in making cocktail-style maraschino cherries) are produced in Oregon. Michigan produces the smaller, stemless maraschino cherries that are used in fruit cocktail. These cherries are likely to have been machine harvested.

Sweet cherries have a relatively short season and the marketing periods for the major producing regions only partly overlap. Prices, consequently, are more closely related to the size of supplies from individual areas than to national output. Grower prices (all sweet cherries) in Oregon and Michigan, where the bulk of production goes for processing, generally average lower than in California and Washington.

All commercial sweet cherry trees are propagated vegetatively. None are grown from seed. Commercial sweet cherry orchards are planted with nursery trees produced by "budding" a selected scion onto the desired rootstock. The rootstock provides the lower trunk and root system, while the scion forms the top of the tree. Budding consists of inserting a dormant bud of the desired sweet cherry variety into a t-shaped slit in the bark of a year-old seedling just above ground level. When the bud grows, the branches associated with the rootstock seedling are cut off and the bud becomes the new tree.

Pollination is required to ensure adequate fruit set. Nearly all sweet cherry cultivars are completely self-incompatible (cannot be fertilized by the pollen of the same cultivar), and some groups of cultivars are cross-incompatible, such as Bing, Lambert and Napoleon (Royal Ann). Carefully-chosen varieties are planted in orchards mainly for pollination purposes. Honeybees are the main pollinating agent for sweet cherries. Growers normally rent hives of bees and place them in the orchards during bloom.

Cherry trees require extensive pruning and training to produce a limb/branch configuration that will maximize productivity. Pruning and training cherry trees is labor intensive. Some pruning is needed annually on all trees to maintain a good supply of fruiting wood.

Most sweet cherry trees in the western U.S. are irrigated. Irrigation is beneficial to sweet cherry trees during dry spells, but too much water is detrimental to the roots. Under-the-tree sprinklers (drip and trickle systems) are typically used to avoid rain-cracking and disease hazards that can accompany overhead systems that wet the fruit.

Sweet cherry trees begin to bear fruit 4-5 years after planting and reach peak production after 8-10 years. Sweet cherry varieties mature at about the same time each year. Some varieties in California are ready for harvest in mid-April and the rest by early May. Harvesting begins in Oregon and Washington in early June, about 65 days after full bloom. Most of Michigan's sweet cherries are harvested in July.

One of the most common production perils affecting sweet cherries is rain near harvest-time, which causes "rain cracking." Cracked cherries are susceptible to fungal infection and the fruit is not marketable. Sweet cherries are most susceptible to cracking during and just prior to harvest. Rain drops striking mature cherries will frequently cause the skin to split or crack. Cracking results from direct absorption of water through the fruit skin, not from excess soil moisture absorbed through the roots

Freezing temperatures are another common peril. Sweet cherry buds are especially susceptible to spring frosts during a period of time before the blossoms are fully open. The fruit are also subject to disease infestations, as well as insect, bird, and rodent abuse.

Our assessment is that there would be widespread participation among sweet cherry growers in the catastrophic insurance plan because of the low cost of participation relative to the potential benefits. There is, however, likely to be much less participation in the buy-up plans than in the catastrophic insurance. Participation in additional insurance coverage is likely to be greatest in Michigan, where growers face frequent losses due to rain cracking and to frosts and freezes. Participation in buy-up insurance in Oregon and Washington is likely to be about the same as, or may slightly exceed, participation for apple insurance in those states. It is our assessment that participation in a sweet cherry insurance policy would be lowest among growers in California.

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Introduction

The sweet cherry is a drupe or stone fruit that belongs to the genus *Prunus*, along with almonds, peaches, plums, and apricots. Both sweet and sour (or tart) cherries belong to the same family, *Rosaceae*, but different species; *Avium* is the sweet cherry species and *Cerasus* is the sour species.

Sweet cherry trees generally have larger leaves and bear larger fruit than sour cherries, and have a markedly sweeter taste. The sweet cherry fruit is described as "dark" or "light" according to skin color. The skin color of dark cherries range from reddish-purple to mahogany; for light cherries, skin color ranges from yellow to yellow with a pink blush (Fogle).

The sweet cherry is considered native to the Caspian-Black Sea area of Europe and to parts of Asia as far east as northern India. Early colonists brought sweet cherry seeds to America, where the first recorded cultivation was in Massachusetts in 1627. The first record of grafted or budded named varieties appeared in New York in 1767 (Fogle). Sweet cherries are now grown commercially in Washington, Oregon, Michigan, and California, as well as in Idaho, Montana, New York, Pennsylvania, and Utah. The harvesting and marketing seasons in each area are relatively short.

Although there are hundreds of sweet cherry cultivars, Bing is the dominant variety in the western states. Other western varieties include Lambert, Rainier, Royal Ann (Napoleon), and Burlat. The main varieties grown in the eastern United States are Gold, Napoleon, Emperor Francis, and Schmidt. About half of U.S. sweet cherry production is sold fresh shortly after harvest and the remainder is brined, canned, frozen, dried, or juiced. Brining is the first step in making maraschino cherries.

Sweet cherries are a high value crop and are especially vulnerable to skin cracking due to rains at harvest-time. They also are highly susceptible to loss due to frost at blossom time and to excessively cold winter temperatures. Rapid movement from the tree to retail sale is a critical factor in maintaining fruit quality. Sweet cherries are very perishable at harvest-time and during packing and transport. Fruit that is small or blemished can often be sold for processing, but at a much lower price than cherries for fresh use.

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

The Sweet Cherry Industry

Most U.S. sweet cherries are grown in the West (Figure 1). Washington and California supply mainly dark, sweet Bing cherries intended for fresh use, while Oregon and Michigan provide light-colored Royal Ann (Napoleon) cherries for the maraschino process. Sweet cherry acreage has grown in the last decade in California and Washington, but has declined in Oregon and Michigan. Most cherry growers have diversified sources of income--other tree fruit or off-farm employment.

Location

Washington is the leading sweet cherry-producing state with its production area located almost entirely in the central region east of the Cascade Mountains. The 1992 Census of Agriculture indicated that about one-half of Washington's sweet cherry acreage was in Yakima and Benton counties (Appendix table 1). Two-thirds of Oregon's sweet cherry output is from an area called The Dalles in north-central Wasco County, along the Columbia River. Michigan sweet cherries are concentrated in the northwest part of the state in Grand Traverse and Leelanau counties. California's production is centered in the San Joaquin Valley.

The Census of Agriculture reported 7,191 farms growing sweet cherries in 1992. There were 1,777 farms with sweet cherries in Washington, 1,112 in Oregon, 1,130 in California and 933 in Michigan (Appendix table 1). The total number of farms remained virtually unchanged between 1987 and 1992, but there were notable changes in location. The number of farms, and the acreage planted with sweet cherries, increased in California and Washington, and declined in Michigan and Oregon. California's acreage increased nearly one-third while Washington's rose 8 percent. Acreage declined 5 percent in Oregon and 2 percent in Michigan.

Farms with Sweet Cherries

A large number of the farms with sweet cherries are small operations. Sixty-five percent had crop sales of less than $25,000 in 1987 and 83 percent had sales less than $100,000 (Appendix table 2). Oregon had the largest share of small farms--72 percent with crop sales less than $25,000--and Washington had the smallest share--50 percent.

Off-farm employment and income from other agricultural crops are important sources of income diversification for sweet cherry growers. Fifty-five percent of the growers reported that farming was their major occupation in 1987, but a nearly equal percentage reported working off the farm at least one day during that year (Appendix table 3). One-third of the farm operators reported working off the farm 200 days or more.

Except in Oregon, products other than sweet cherries accounted for the majority of farm sales. Sweet cherries accounted for 22 percent of sales on

California farms, 26 percent on Michigan farms, and 27 percent on Washington farms (Table 1). Sweet cherries are likely to be a secondary crop to apples

Table 1--Market value of sales from farms producing sweet cherries, 1987

State	All products	All crops	Fruit & nuts	Sweet cherries	Sweet cherries % of all products
	--------------------Million dollars---------------				Percent
California	129	121	74	29	22
Michigan	69	65	55	18	26
New York	30	28	23	1	3
Oregon	62	59	49	37	60
Pennsylvania	35	25	21	1	3
Utah	9	6	5	1	11
Washington	256	236	200	68	27
Other	47	42	26	4	9
U.S.	637	582	453	159	25

Note: The category "other" is computed as the U.S. total minus listed states.

Source: 1987 Census of Agriculture and USDA, NASS.

and pears in Washington (Pace-Opfer). In Michigan, tart cherries are likely to be the primary crop, while sweet cherries and perhaps apples and plums are secondary crops (Ricks).

Sweet cherries accounted for an estimated 60 percent of 1987 farm sales on Oregon sweet-cherry farms. Growers in The Dalles area of Oregon are more specialized in sweet cherries than in other areas. In the Willamette Valley, apples, pears, and non-farm employment are important income sources, in addition to sweet cherries (Long).

The Sweet Cherry Market

U.S. sweet cherry output changes substantially from year to year, due mostly to weather-related yield variation. Imports of fresh and canned sweet cherries are small compared to U.S. production and do little to stabilize supplies. Harvesting and marketing seasons are short compared to some other fresh-market fruits, and price fluctuations can be substantial. Domestic consumption of fresh sweet cherries declined as exports rose during the 1980's and 1990's. Exports claimed about one-third of 1990-93 fresh sweet cherry supplies and are especially important to Washington and California growers.

Supply

Production of sweet cherries in the nine states reported by USDA (Washington, Oregon, California, Michigan, Pennsylvania, New York, Montana, Idaho, and Utah) has fluctuated during the last 10 years from 430 million pounds in 1987 to only 265 million pounds in 1985 (Table 2). Washington has been the leading producer, with an average 154.5 million pounds in 1991-94, followed by Oregon (84 million pounds), California (69 million pounds), and Michigan (47 million pounds). Acreage has risen since the mid-1980's in California and Washington, but has declined in Michigan (Table 3). Oregon's cherry production rose despite a slight decline in average bearing acres, due to an increase in per-acre yields.

All states show large fluctuations in annual yields. The average yield in Oregon rose from less than 6,000 pounds per acre in 1984-86 to nearly 8,000 pounds in 1991-94 (Table 4). Yields in California climbed from about 4,300 to 6,000 pounds per acre during the same period, while Michigan's yields declined from 6,800 to about 6,300 pounds. Washington has the most acreage and the highest yields, averaging nearly 11,000 pounds per acre.

About half of the U.S. sweet cherry crop is typically used fresh and half is processed. Cherries may be processed that cannot be effectively marketed during the short harvest season, or that are undersized and/or blemished and do not meet fresh-grade standards. About 70 percent of the sweet cherries processed in 1991-94 were brined, about 10 percent were canned, and nearly 20 percent were frozen, dried, or used for juice (Table 5 and Figure 2). Brining is the first step in the maraschino process.

Table 2--Sweet cherries: Total production 1/, 1984-94

States 2/	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Million pounds										
Washington	136.0	75.8	125.0	148.0	124.0	168.0	132.0	100.0	194.0	160.0	164.0
Oregon	62.0	58.0	76.0	108.0	120.0	104.0	96.0	80.0	104.0	68.0	84.0
California	74.4	47.0	16.8	90.0	52.0	52.0	44.0	72.0	62.0	38.0	104.0
Michigan	66.0	62.0	40.0	64.0	56.0	50.0	32.0	42.0	36.0	60.0	50.0
Utah	8.4	4.4	4.3	3.6	4.0	3.4	2.8	1.6	6.4	2.5	4.6
Idaho	5.6	4.4	4.6	4.2	4.6	5.4	4.0	0.8	2.4	3.0	2.6
New York	4.8	3.2	3.4	3.0	2.8	2.7	2.0	2.5	2.2	1.4	1.8
Pennsylvania	1.8	1.0	2.1	1.6	2.4	1.4	0.1	2.2	2.2	2.4	1.9
Montana	4.6	9.2	3.2	7.6	6.6	3/	0.6	2/	1.6	1.8	1.5
United States	363.6	265.0	275.4	430.0	372.4	386.9	313.5	301.1	410.8	337.1	414.4

1/ Includes unharvested production and harvested but not sold.
2/ Sorted by average 1990-94 production.
3/ No commercial production due to frost.
Source: USDA, National Agricultural Statistics Service.

Table 3--Sweet cherries: Bearing acreage, selected states, 1984-94

States	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Acres										
California	10,800	10,900	10,400	10,300	10,000	10,200	10,600	10,800	11,200	11,600	12,000
Michigan	8,000	8,200	8,600	9,100	9,400	9,700	9,900	7,500	7,300	7,700	7,400
New York	1,200	1,000	900	850	700	650	600	500	500	450	450
Oregon	10,800	10,900	11,000	11,500	11,800	12,100	12,300	10,300	10,400	10,400	10,500
Utah	na	na	na	na	na	na	na	690	660	630	630
Washington	11,200	11,200	11,900	12,200	12,800	13,300	13,600	13,800	14,000	14,200	14,500
United States	44,490	44,790	45,410	46,570	47,520	48,620	49,210	44,980	45,420	46,090	46,680

na: Not available.
Source: USDA, National Agricultural Statistics Service.

Table 4--Sweet cherries: Average yield per acre 1/, selected states, 1984-94

States	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Pounds/acre										
California	6,880	4,320	1,620	8,740	5,200	5,100	4,160	6,660	5,540	3,280	8,660
Michigan	8,260	7,560	4,660	7,040	5,960	5,160	3,240	5,600	4,940	7,800	6,760
New York	4,000	3,200	3,780	3,520	4,000	4,160	3,340	5,000	4,400	3,120	4,000
Oregon	5,740	5,320	6,900	9,400	10,160	8,600	7,800	7,380	10,000	6,540	8,000
Utah	na	na	na	na	na	na	na	2,320	9,700	3,960	7,300
Washington	12,140	6,760	10,500	12,140	9,680	12,640	9,700	7,240	13,860	11,260	11,320
United States	8,180	5,920	6,060	9,240	7,840	7,960	6,360	6,600	9,040	7,300	8,880

na = not available.
1/ Yield is based on total production and bearing acreage.
Source: USDA, National Agricultural Statistics Service.

Table 5--Sweet cherries: Total production and utilization, selected states, 1984-94 1/

States	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	----Million pounds----										
California	74.4	47.0	16.8	90.0	52.0	52.0	44.0	72.0	62.0	38.0	104.0
Fresh	55.2	38.7	13.2	68.0	39.0	37.0	32.6	54.0	51.0	29.0	72.0
Processed	19.2	8.3	3.6	22.0	13.0	15.0	11.4	18.0	11.0	9.0	32.0
Michigan	66.0	62.0	40.0	64.0	56.0	50.0	32.0	42.0	36.0	60.0	50.0
Fresh	6.0	6.0	8.0	12.0	11.0	9.0	5.0	3.0	1.2	2.4	2.2
Processed	56.0	56.0	32.0	52.0	45.0	41.0	22.0	39.0	32.8	51.6	43.8
Brined	35.2	38.4	20.0	33.6	33.9	31.6	18.0	28.0	24.7	41.2	31.8
Canned	10.6	9.2	4.0	8.6	4.9	3.7	3.5	4.7	5.6	4.0	4.6
Other	10.2	8.4	8.0	9.8	6.2	5.7	0.5	6.3	2.5	6.4	7.4
Oregon	62.0	58.0	76.0	108.0	120.0	104.0	96.0	80.0	104.0	68.0	84.0
Fresh	20.0	8.0	17.0	26.0	32.0	30.0	21.0	18.0	30.0	22.0	16.0
Processed	39.0	46.0	59.0	82.0	88.0	70.0	59.0	55.0	74.0	46.0	60.0
Brined	29.6	35.6	48.6	66.0	62.0	54.0	40.0	42.0	56.0	35.4	49.0
Canned	4.6	7.4	5.8	8.2	17.2	10.0	11.6	6.0	8.0	6.6	5.0
Other	4.8	3.0	4.6	7.8	8.8	6.0	7.4	7.0	10.0	4.0	6.0
Washington	136.0	75.8	125.0	148.0	124.0	168.0	132.0	100.0	194.0	160.0	164.0
Fresh	85.0	40.4	88.2	99.0	79.2	122.6	77.6	53.2	102.0	100.0	100.0
Processed	26.6	30.2	36.8	49.0	44.8	45.4	28.4	32.8	70.0	52.0	48.0
Brined	11.2	15.4	24.0	25.0	23.8	17.8	8.0	15.0	38.0	30.0	19.0
Canned	3.6	6.0	5.0	7.6	7.8	12.2	3.0	5.0	9.0	8.0	10.2
Other	11.8	8.8	7.8	16.4	13.2	15.4	17.4	12.8	23.0	14.0	18.8
United States	363.6	265.0	275.4	430.0	372.4	386.9	313.5	301.1	410.8	337.1	414.4
Fresh	181.0	106.1	136.6	216.3	174.5	207.0	141.0	133.4	190.8	159.6	198.7

Processed	147.5	146.9	136.9	209.8	194.6	174.8	123.7	146.4	193.3	161.5	187.0
Brined	100.9	102.8	101.1	149.9	135.2	116.0	79.3	103.3	133.2	115.5	129.0
Canned	18.8	22.6	14.8	24.4	29.9	29.9	18.1	15.7	22.6	18.6	19.8
Other	27.8	21.5	21.0	35.5	29.4	28.9	26.3	27.4	37.5	27.4	38.2

1/ Fresh and processed utilization will not add to total production.

Source: USDA, National Agricultural Statistics Service.

Michigan and Oregon accounted for 64 percent of U.S. brined cherries during 1991-94. Most premium-quality handpicked cherries with the stems attached (used in making cocktail-style maraschino cherri are produced in Oregon. Michigan produces the smaller, stemless maraschino cherries that are used i fruit cocktail. These cherries are likely to have been machine harvested.

Eighty-two percent of the U.S. fresh cherry supply came from California and Washington in 1991-94. California sweet cherries are usually fresh marketed in May and June. Washington ships sweet cherri in June and July.

Imports of fresh sweet cherries averaged less than 4 million pounds in 1991-94, just about 2 percent U.S. supplies (Table 6). Imports of canned cherries (excluding maraschino) have also been small (Ta 7). The United States is a net exporter of maraschino cherries, importing 135,000 pounds and export more than 10 million pounds in 1994.

Demand

U.S. consumption of sweet cherries has declined during the past 15 years, despite stable production. Per capita consumption of fresh sweet cherries averaged 0.46 pounds per person during 1991-94, down 0.65 pounds during 1975-79 (Table 6). While never very large, consumption of canned cherries declin from 0.05 pounds to 0.03 pounds (Table 7).

These figures do not include consumption of maraschino and frozen cherries, for which no estimates a made. Health concerns about the presence of sulfites and red dye #3 in maraschino cherries, however may also be causing their consumption to decline (McAllister). Frozen sweet cherries are mostly use the production of ice cream and yogurt, for which demand reportedly has been relatively unchanged.

Sweet cherry producers benefit from a strong export demand. The U.S. exported about one-third of it fresh sweet cherry supplies in recent years, compared to 24 percent in 1985-89 and 14 percent in 198 84. Japan is the top export market for fresh U.S. sweet cherries. All other countries (mainly Taiw Canada, Hong Kong, and the United Kingdom) received less than 50 percent of U.S. sweet cherry export 1994.

Prices

Sweet cherries have a relatively short season and the marketing periods for the major producing regi only partly overlap. Prices, consequently, are more closely related to the size of supplies from individual areas than to national output. In 1993, for example, rain damage reduced the California and grower prices (all sweet cherries) rose 83 percent above the year earlier (Table 8). Prices for Washington cherries, which ripened too late to supplement California's short crop, rose only 42 perc

Grower prices (all sweet cherries) in Oregon and Michigan, where the bulk of production goes for processing, generally average lower than in California and Washington (Figures 3 and 4). Oregon gro prices usually average higher

Table 6--Fresh-Market sweet cherries: Supply and utilization, 1975-94 1/

Year	Utilized production	Imports	Total supply	Exports	Consumption Total	Consumption Per capita
	Million pounds					Pounds
1975	154.6	0.3	154.9	12.2	142.7	0.661
1976	189.0	0.1	189.1	16.4	172.7	0.792
1977	144.6	0.1	144.7	12.0	132.7	0.603
1978	133.3	0.1	133.4	19.1	114.3	0.514
1979	172.1	2.6	174.7	26.4	148.3	0.659
1980	172.9	1.5	174.4	23.8	150.6	0.661
1981	143.5	0.2	143.7	24.5	119.2	0.518
1982	135.2	0.3	135.5	20.8	114.7	0.494
1983	190.2	1.0	191.2	24.9	166.3	0.710
1984	181.0	1.6	182.6	23.0	159.6	0.675
1985	106.1	4.1	110.2	16.1	94.1	0.395
1986	136.6	2.0	138.6	24.3	114.3	0.475
1987	216.3	4.9	221.2	52.9	168.3	0.693
1988	174.5	4.1	178.6	53.7	124.9	0.510
1989	207.0	3.7	210.7	63.1	147.7	0.597
1990	141.0	3.1	144.1	50.2	93.9	0.376
1991	133.4	3.0	136.3	38.0	98.4	0.389

1992	:	190.8	4.6	195.5	67.6	127.9
0.501						
1993	:	159.6	3.5	163.2	56.0	107.2
0.415						
1994	:	198.7	3.5	202.2	65.8	136.4
0.523						

1/ Fresh utilization, NASS/USDA.

Source: USDA, ERS (unpublished estimates).

Table 7--Canned sweet cherries: supply and utilization, 1975/76-93/94

Year 1/	Supply				Utilization		Consumption	
	Production 2/	Imports	Beginning stocks	Total supply	Ending stocks	Exports	Total	Per capita
	Million pounds							Pounds
1975/76	13.1	NA	13.1	26.2	9.7	2.3	14.2	0.065
1976/77	15.9	NA	9.7	25.6	5.7	3.1	16.8	0.077
1977/78	14.9	NA	5.7	20.6	5.9	5.5	9.2	0.042
1978/79	18.1	NA	5.9	24.0	5.1	11.1	7.8	0.035
1979/80	21.0	NA	5.1	26.1	10.6	11.0	4.5	0.020
1980/81	20.4	NA	10.6	31.0	9.7	10.0	11.3	0.049
1981/82	14.6	NA	9.7	24.3	4.9	8.9	10.5	0.045
1982/83	15.1	NA	4.9	20.0	7.6	7.2	5.2	0.022
1983/84	15.7	NA	7.6	23.3	9.0	7.5	6.8	0.029
1984/85	13.3	NA	9.0	22.3	5.9	7.6	8.8	0.037
1985/86	16.0	NA	5.9	21.9	7.2	8.4	6.3	0.026
1986/87	10.5	NA	7.2	17.7	4.3	12.8	0.6	0.002
1987/88	17.3	NA	4.3	21.6	6.8	13.5	1.3	0.005
1988/89	21.1	0.2	6.8	28.1	7.2	14.5	6.4	0.026
1989/90	21.1	0.4	NA	21.5	NA	10.5	11.0	0.044

1990/91 :	12.8	0.5	NA	13.3	NA	11.8	1.5	0.006
1991/92 :	14.7	0.5	NA	15.2	NA	7.5	7.7	0.030
1992/93 :	16.0	0.5	NA	16.6	NA	9.4	7.1	0.028
1993/94 :	13.2	0.5	NA	13.7	NA	8.4	5.2	0.020
1994/95 :	14.0	0.5	NA	14.6	NA	8.1	6.4	0.025

NA = Not available.
1/ Season begins May 1 of the first year shown.
2/ NASS canned utilization estimates converted to product weight.

Source: USDA, ERS (unpublished estimates).

Table 8--Sweet cherries: Prices received by growers, selected states, 1984-94

States	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
				--Cents/pound--------------------------							
California	34.4	52.5	61.0	31.8	38.6	47.0	44.6	47.9	62.0	113.5	61.0
Fresh	40.2	58.0	69.5	34.3	43.7	56.0	54.0	52.5	69.0	141.0	77.5
Processed	17.6	26.5	28.8	24.1	23.1	24.7	17.6	33.8	28.7	25.7	24.1
Michigan	21.2	25.0	28.8	28.8	32.9	23.4	25.6	33.6	34.5	34.7	29.4
Fresh	44.6	37.6	40.0	45.3	62.5	39.4	59.5	48.7	60.0	65.0	65.0
Processed	18.7	23.7	26.0	25.0	25.6	19.9	17.9	32.4	33.5	33.3	27.6
Oregon	24.6	31.1	33.2	34.5	32.4	27.6	32.2	43.6	43.4	44.7	36.6
Fresh	27.4	43.1	43.0	49.8	41.7	32.5	50.0	62.0	62.5	54.0	54.5
Processed	23.1	29.0	30.3	29.7	29.0	25.4	25.9	37.5	35.7	40.2	31.9
Washington	36.5	51.5	47.6	46.2	49.2	40.1	59.0	60.0	43.6	62.0	60.0
Fresh	43.4	71.5	57.0	56.5	66.0	47.5	75.0	80.0	55.0	77.5	75.5
Processed	14.2	25.3	24.9	25.3	19.3	20.3	15.5	27.5	26.9	31.8	27.5
United States	30.5	40.0	41.2	37.4	39.4	35.7	44.7	48.4	45.8	59.5	52.0
Fresh	40.0	59.5	54.5	47.7	55.0	46.6	65.5	65.0	60.0	85.0	74.0
Processed	18.9	25.8	27.6	26.8	25.5	22.7	21.2	33.4	31.5	34.3	28.3

Source: USDA, National Agricultural Statistics Service.

than in Michigan, with processing cherry prices averaging 36 cents a pound in Oregon and 32 cents in Michigan during 1991-94. Oregon growers produce premium, hand-picked cherries with the stems attach that are used for cocktail-style maraschino cherries.

In California and Washington, processing is a secondary use to the fresh market and cherries sold fo processing have a substantially lower value than in Oregon and Michigan. Processing prices average cents a pound in both California and Washington in 1991-94.

Fresh sweet cherry prices display a definite seasonal pattern, declining during May as volume increa and remaining relatively flat during June and July (Figure 5). Prices for Bing cherries shipped fro California are the highest and most variable in early May when harvest begins (Appendix tables 4 and 5).

Cultivation and Management Practices

Sweet cherry trees, if permitted to grow unchecked, will become quite tall and spreading, but in commercial plantings trees are usually pruned and kept less than 15 feet tall. The fruit is a berry consisting of a single seed (stone) surrounded by flesh, growing on a 1-to-3-inch long stem. Sweet cherries can be round or heart-shaped, with a diameter between 0.5 and 1.5 inches.

Varieties

There are more than 500 sweet cherry cultivars, but less than 20 are currently commercially importa in the United States. In addition to skin color, varieties differ in their resistance to rain cracking, cold tolerance, and hardiness. Some varieties are more suited to growing conditions in o area than another. Fresh market handlers in the western states want cultivars that are firm enough withstand shipment to retail outlets, while growers in the East prefer softer varieties that have greater rain-cracking resistance (Fogle).

Bing, Lambert, and Napoleon (Royal Ann) varieties are dominant in the western states, along with the more recently introduced Rainier, Larian, and Early Burlat. The top varieties in Michigan are Gold, Napoleon, Emperor Francis, Schmidt, and Hedelfingen. Lambert, Napoleon, and Rainier varieties can b grown successfully in the East, but not Bing.

<u>Bing</u>

Bing is the dominant sweet cherry cultivar grown commercially. This variety originated in Oregon fr a seedling tree grown from the Black Republican cultivar in 1875. Although not as vigorous as some varieties, Bing produces large, firm, mahogany-colored fruit with excellent storage and shipping qualities. The stone is relatively small and the flesh is thick, crisp, and juicy. Bing cherries ripen in early mid-season and have a distinctive high gloss and tangy flavor. However, the fruit is susceptible to rain-cracking, doubling (two fruit on the same stem), and brown rot (a fungal infection). In the Pacific Northwest, Bing cherry trees are reasonably vigorous but lack cold hardiness and are susceptible to a number of viral diseases (Fogle).

<u>Lambert</u>

The Lambert cultivar originated from a Napoleon seedling in Oregon around 1880. Lambert has wider geographic adaptation than Bing because the trees are more vigorous and cold tolerant. Like the Bi variety, Lambert fruit is susceptible to rain cracking. Lambert cherries are moderately firm and da colored, but not as dark as Bing. They have a milder flavor and ripen about a week later than Bing. Lambert cherries are firm enough to be transported for fresh use and are also suitable for processi (Fogle).

Napoleon (Royal Ann)

The Napoleon variety originated in Europe prior to 1667 and was renamed Royal Ann when brought to Oregon about 1850. This cultivar is commonly referred to as Napoleon in the East and Royal Ann in t West. The fruit flesh ranges from nearly clear to yellow, and the skin has a variable amount of pi blush on a yellow background. Napoleon cherries usually ripen a few days before Bing, but the easi bruised fruit is not suitable for long distance shipping.
The fruit is moderately firm-fleshed with a slightly acidic flavor, and is widely used for canning a brining. Although hardy when dormant, Napoleon trees are less tolerant of extreme cold than Lambert and are quite susceptible to rain cracking and bacterial canker (Fogle). Royal Ann is the main swee cherry variety grown in Oregon and, until recently, Napoleon accounted for the largest portion of sweet-cherry acreage in Michigan.

Rainier

The Rainier variety was developed in Washington and introduced in 1960 by the U.S. Department of Agriculture and the Washington Agricultural Experiment Station. It combines cold hardiness with lar fruit size. The fruit's skin color is yellow with considerable pink blush, the flesh is clear, and juice is colorless. Rainier and Bing are compatible cross-pollinators with coincident blossoming an foliation periods. Rainier cherries have sufficient firmness for distant shipping and are suitable brining and canning (Fogle). Rainier is frequently used as pollinator for Napoleon in the East.

Larian

Larian was developed from crosses of Lambert, Bing, and Tartarian cultivars and introduced in 1964 b the California Agricultural Experiment Station. The dark-fleshed fruit ripens about one-and-a-half weeks before Bing, but blossoms about the same time and is compatible for pollination. The fruit is larger, firmer and better-flavored than Black Tartarian. Larian cultivars are less prone to produce fruit doubles (two fruit on the same stem) and more resistant to rain-cracking than Bing (Fogle).

Burlat

Early Burlat is another dark-fleshed, early-season cultivar introduced in California in 1961. The trees are relatively vigorous. The fruit is susceptible to rain cracking but has less tendency to produce fruit doubles than Bing (Fogle). This variety has become popular in the interior valleys of California, where excessive heat is generally more problematic than rain.

Black Republican

Black Republican is thought to be a cross of Napoleon and Black Tartarian that originated as a seed in an orchard of Seth Lewelling in Oregon about 1850. The fruit is dark red with mahogany skin. Th tree has a tendency to produce a large number of usually small cherries (Fogle). Black Republican i mainly planted in the West as a pollinator, and most of the fruit is frozen.

Gold

Gold, the dominant variety in Michigan, has been available for many years. It has yellow skin with blush and is well-suited to brining. Gold trees are hardy and consistently bear a large number of small fruit. Gold cherries mature later than Napoleon, but they are less susceptible to brown rot a cracking than Napoleon cherries (Nugent).

Emperor Francis

Emperor Francis is another popular cultivar used for brining in Michigan. The fruit is a similar co to that of Napoleon, but the cherries are larger and they mature earlier. Emperor Francis was developed prior to 1914 (Nugent).

Schmidt

Schmidt originated about 1840 in Germany. The dark-mahogany fruit is large, with thick skin, a larg stone, and firm, wine-red flesh. It has a rather astringent taste. Schmidt cherries usually ripen few days before Bing, and rain cracking is less of a problem than it is with either Bing or Lambert. The tree is hardy. Although Western growers consider Schmidt a low-producing variety, it is the dar cherry cultivar of choice in areas where Bing cannot be successfully grown (Fogle).

Hedelfingen

Hedelfingen is an old German cultivar that has fairly good rain-cracking resistance. The fruit is f and dark mahogany, with a slightly astringent taste that is similar to Black Republican (Fogle). It grown in Michigan and used for freezing and canning.

Propagation and Planting

All commercial sweet cherry trees are propagated vegetatively. None are grown from seed. Commercia sweet cherry orchards are planted with nursery trees produced by "budding" a selected scion onto the desired rootstock. The rootstock provides the lower trunk and root system, while the scion forms th top of the tree. Budding consists of inserting a dormant bud of the desired sweet cherry variety in a t-shaped slit in the bark of a year-old seedling just above ground level. When the bud grows, the branches associated with the rootstock seedling are cut off and the bud becomes the new tree.

Sweet cherry trees for commercial uses are grown almost entirely on mazzard (*Prunus avium*) or mahale (*Prunus mahaleb*) rootstocks. Choice of a rootstock depends on soil and site. Mazzards are the most common rootstocks used in Washington and Oregon. Mahaleb is better for arid climates and light, wel drained soils.

Mahalebs and mazzards have different characteristics. Although mahaleb roots are susceptible to dam by gophers, the trees are more disease resistant. Mazzard rootstocks are more tolerant of poorly-drained soils and are generally longer-lived than mahalebs. Trees with mahaleb rootstocks tend to remain smaller, but are earlier fruiting and harden earlier than those with mazzard rootstocks. In areas of California where poor drainage is a problem, trees on "Stockton Morello" (*Prunus cerasus*) rootstock do better than either mazzard or mahaleb (Fogle).

Some cherry trees are composed of three distinct parts: rootstock, a dwarfing interstock, and a sci "Interstock" refers to the section of the trunk (or the trunk and crotch portions of the tree) that grafted to the rootstock. The desired fruiting cultivar is budded onto the interstock. This propagation technique is used in order to obtain earlier fruiting, reduced tree size, and increased hardiness of the trunk (Fogle).

A propagation method called "topworking" may be used to change the variety of an established tree. topworking, buds or grafts are placed on main-leader branches of bearing-age trees (Fogle).

Traditionally, planting occurs from February to April, although fall planting is used in temperate climates. Fall planting may occur as far north as New York, Michigan, and Washington, and offers th advantages of better weather and the availability of freshly-dug nursery trees.

Growers typically plant one-year-old nursery trees that were propagated nearly two years earlier. Nurserymen prefer to bud trees on a custom basis, rather than risk propagating varieties that may nc be in demand. Cultivars should be selected based on marketing outlets (which influence cultivar chc based on fruit firmness), soil conditions, and local weather conditions (rain and temperatures). Ir addition to the choice of rootstock and scion for the main cultivar, a different, but compatible, variety must be chosen for pollination (Fogle).

Pollination

Pollination is required to ensure adequate fruit set. Nearly all sweet cherry cultivars are complet self-incompatible (cannot be fertilized by the pollen of the same cultivar), and some groups of cultivars are cross-incompatible, such as Bing, Lambert and Napoleon (Royal Ann). Carefully-chosen varieties are planted in orchards mainly for pollination purposes. Without pollinators, virtually r fruit would be produced by the main cultivar. A good pollinator must bloom at the same time as the main variety and have compatible pollen. A ratio of eight trees of the main cultivar to one pollina tree is usually adequate (Fogle).

Honeybees are the main pollinating agent for sweet cherries. Growers normally rent hives of bees ar place them in the orchards during bloom. Two colonies per acre, providing at least 30-35 bees per t per minute, are recommended for maximum pollination in the Pacific Northwest.

Weather conditions during bloom have an affect on fruit set and ultimately, on yields. Cool weather (below 65° F), as well as rain or fog during the bloom period, can inhibit pollinating activities of bees, resulting in short crops. In addition, high temperatures (above 75° F) for more than four hou can reduce pollen viability and germination (Mayer).

Pruning

Cherry trees require extensive pruning and training to produce a limb/branch configuration that wil maximize productivity. Pruning and training cherry trees is labor intensive. Some pruning is neede annually on all trees to maintain a good supply of fruiting wood.

Young trees require the most attention. For young trees, training includes pinching young terminals back 3 or 4 inches during the growing season, and heading (shortening upright main branches) when tr are dormant. Heading forces lateral branches to be low and produces shorter trees that can be easi harvested (Fogle).

Since the best fruit is produced on young, strong spurs on the base of one-year-old wood, growth of wood must be encouraged to maximize yields. A shoot or spur only bears fruit one time, so limbs tha have fruited for a number or years are removed to make room for new, more productive limbs.

The most extensive pruning involves removing major vertical, secondary, and tertiary scaffold branch that have become unfruitful or crowded. A less extensive pruning removes vigorous, non-fruiting, 1- and 2-year-old wood. A very light pruning to remove some fruiting wood may be done to encourage the production of fewer, larger cherries (Proebsting). Extensive pruning will enhance yields over the l run, but yields may drop temporarily. Pruning more frequently and less extensively (1- or 2-year o wood) is recommended to minimize yield loss.

Water

Most sweet cherry trees in the western U.S. are irrigated. Irrigation is beneficial to sweet cherry trees during dry spells, but too much water is detrimental to the roots. Under-the-tree sprinklers (drip and trickle systems) are typically used to avoid rain-cracking and disease hazards that can accompany overhead systems that wet the fruit (Fogle).

Sweet cherry trees in the Pacific Northwest are tolerant of some water stress. However, during fru set and final fruit swell, a shortage of water may restrict yields. Irrigation may be needed prior bloom if soil moisture is low, but no additional irrigation is usually needed until 3-4 weeks before harvest, when cherries attain 3/4 of their mature size (Proebsting).

After the fruit is harvested, water requirements drop and brief periods of dry soil will not harm th tree or the subsequent crop. Irrigating in late August can help prevent root/crown injury during th winter, but excessive moisture reduces flower bud hardiness (Proebsting).

Soil

Soils should be relatively light and moderately productive. Excess fertility may cause leggy growth delay fruiting, and promote greater susceptibility to winter injury or disease. Sweet cherries on mazzard rootstocks will grow best on sandy loam soil. They are not tolerant of clay or any poorly-drained heavy soil and will not do well on sandy soil without irrigation. Trees on mahaleb rootstoc are more tolerant of sandy soils and moisture deficiencies, while those on morello rootstocks tolera wet soils better than mazzard (Fogle).

Cultivation of cherry orchards is usually required since weeds compete with young trees for nutrient and water. Weeds can also harbor insects, diseases, nematodes, and rodents. Mechanical cultivatior herbicides can be used for weed control. Cover crops may be planted in strips between trees, especially if soil erosion is a problem (Fogle).

Fertilization

Sweet cherry orchards that are not planted to a leguminous cover crop are most likely to suffer fro nitrogen deficiency. Phosphorus, potassium, calcium, and magnesium are usually present in adequate quantities in most soils. Zinc and boron are the most likely micro-elements to be deficient. Zinc deficiency causes "rosette" or "little leaf," in which interveinal chlorosis or shortened internodes appear, buds fail to grow, and/or leaves are small (Fogle).

Leaf analysis and careful year-to-year observation are considered better indicators of fertilizer ne than soil tests. Cherry trees are adversely affected by both a deficiency and an excess of nitrogen Nitrogen can be applied to the soil in the late fall or early spring with annual rates between 100 a

250 pounds per acre. Zinc and boron are usually sprayed in the late fall if leaves appear chlorotic necrotic (Fogle).

Pesticides

Fungicides are used by cherry growers to prevent fungal infection of the fruit and foliage and are generally applied twice a year, during bloom and before harvest, depending on conditions. Various fungicides are used to combat brown rot, cherry leaf spot, cytospora canker, coryneum blight, and powdery mildew. Copper sulfate spray is usually applied when the trees are dormant to prevent bacterial canker infection of leaves and blossoms.

Insecticide sprays are used to control fruit flies, mites, and leaf rollers during the growing seaso especially in the western states. When trees are dormant, insecticides are applied to destroy aphic scale, and borers. Spraying for plum curculios may be necessary east of the Rocky Mountains. Pesticide pellets are used to control gopher populations in the West.

Labor

Sweet cherry production requires labor for the planting of trees, pruning, training, and harvesting. Trees can be mechanically planted when establishing a new orchard on level ground, but replacements typically planted by hand. A mature orchard in the Northwest was estimated to require 20 hours of labor per acre each year for training and pruning (Seavert).

Labor is also required for field operations, such as fertilizing and spraying herbicides and insecticides. Cherries intended for fresh use are hand harvested, which requires a relatively large crew for a short period of time. Harvest in Washington, Oregon, and California is nearly all by har and very labor intensive, while in Michigan, mechanical harvesting of processing cherries reduces la requirements.

Costs of Production

Cost of production information provides an indicator of the size of losses occurring at different stages in the growing and harvesting cycle. Cost data for sweet cherries illustrate that the on-tre value of the fruit is substantially less than the market value.

Hand picking accounts for about 30 to 50 percent of the variable expenses for growing and harvesting acre of average-yielding sweet cherries (Tables 9-13). The harvesting cost percentage rises as yielc increase because cultural and overhead expenses per box decline, while harvesting expenses remain relatively constant.

Mechanical harvesting is somewhat less expensive than hand picking. In Michigan, the cost of mechanically harvesting a 6,000-pound yield for processing accounts for only 22 percent of total growing and harvesting expenses, compared with 47 percent for hand picking.

Packing and selling expenses further boost the total variable costs faced by growers at the point of harvest. Estimates for the San Joaquin Valley in California indicate that picking, packing, cooling and selling cost $10.65 per 22-pound box. The total variable expenses for harvesting, packing, cooling, and selling are about 60 percent of total production costs.

Marketing Sweet Cherries

Harvesting

Sweet cherry trees begin to bear fruit 4-5 years after planting and reach peak production after 8-1(years. Sweet cherry varieties mature at about the same time each year. Some varieties in Californ: are ready for harvest in mid-April and the rest by early May. Harvesting begins in Oregon and Washington in early June, about 65 days after full bloom. Most of Michigan's sweet cherries are harvested in July (Table 14).

The degree of maturity when picked is a major determinant of cherry quality and shelf-life. Cherri(do not continue ripening in storage and those picked too early will have an astringent, sour taste, may shrivel soon after harvest. If fully ripe or overmature when picked, cherries quickly lose the: gloss and flavor and are more susceptible to decay.

Both color and soluble solids are used as indicators of cherry maturity. For dark-colored varieties mahogany skin indicates maturity. Maturity of light-colored varieties is indicated when the area n(covered by red blush (the ground color) turns from pale yellow to light gold. Soluble-solid (sugar) content of expressed juice can be determined with a refractometer, with a range of 17 to 19 percent usually assuring good quality. However, taste is most often used to gauge sugar content and ripenes (Fogle).

After the fruit matures, harvest dates are particularly critical for sweet cherries. Mature sweet cherries can be held on the tree for only 7-10 days and during that time most varieties are very susceptible to rain cracking (Fogle). By using cultivars with different maturity dates and planting a range of climatic conditions, growers may extend the harvesting season over a 3-6 week period. Sw cherries intended for fresh use are picked by hand with the stems attached to minimize shrinkage dur storage and transit. Care must be taken during handling to avoid punctures and scratches by the ste Cherries intended for fresh use are not mechanically harvested. Mechanical harvesting detaches the stems, which accelerates fruit breakdown and shortens shelf-life. Cherries that are brined immediat can be mechanically harvested (Fogle).

Table 9--Costs of producing sweet cherries for fresh market in northwestern Michigan, 1989

Item	Yield (pounds per acre) 2,000	4,000	6,000	8,000	10,000
	----------------Cents per pound-------------				
Cultural cost	32.6	16.3	10.9	8.2	6.5
Harvest cost 1/	21.9	21.9	21.9	21.9	21.9
Interest on operating capital	1.6	0.8	0.5	0.4	0.3
Total operating costs	56.1	39.0	33.3	30.5	28.7
Overhead costs	39.6	19.8	13.2	9.9	7.9
Total costs	95.7	58.8	46.5	40.4	36.6
Harvest percent of total	23%	37%	47%	54%	60%

1/ Includes picking ($0.18/lb) and hauling costs.

Source: Cooperative Extension Service, Michigan State University, Extension Bulletin E-2190.

Table 10--Costs of producing sweet cherries for processing in northwestern Michigan, 1989

Item	Yield (pounds per acre) 2,000	4,000	6,000	8,000	10,000
	Cents per pound				
Cultural cost	33.0	16.0	11.0	8.0	7.0
Harvest cost	7.0	7.0	7.0	7.0	7.0
Interest on operating capital	1.6	0.8	0.5	0.4	0.3
Total operating costs	41.6	23.8	18.5	15.4	14.3
Overhead costs	40.0	20.0	13.0	10.0	8.0
Total costs	81.6	43.8	31.5	25.4	22.3
Harvest percent of total	9%	16%	22%	28%	31%

Source: Cooperative Extension Service, Michigan State University, Extension Bulletin E-2191.

Table 11--Costs of producing sweet cherries in central Washington, 1990

Item	Yield (pounds per acre) 8,000	10,000	12,000	14,000	16,000
	Cents per pound				

Cultural cost	21.5	17.2	14.4	12.3	10.8
Harvest cost 1/	14.1	14.1	14.1	14.1	14.1
Interest on operating capital	1.9	1.5	1.3	1.1	1.0
Total operating costs	37.6	32.9	29.8	27.5	25.9
Cash overhead costs	4.8	3.9	3.2	2.8	2.4
Noncash overhead costs	19.1	15.2	12.7	10.9	9.5
Total costs	61.5	52.0	45.7	41.2	37.8
Harvest percent of total	23%	27%	31%	34%	37%

1/ Includes picking ($0.12/lb) and hauling costs.
Source: Cooperative Extension Service, Washington State University, EB-1606.
Note: Costs for 14,000 pound yield were given, remainder calculated by ERS.

Table 12--Costs of producing sweet cherries in Wasco County, Oregon, 1992

	Yield (pounds per acre)				
Item	8,000	10,000	12,000	14,000	16,000
	Cents per pound				
Cultural cost	10.6	8.5	7.1	6.1	5.3
Harvest cost 1/	13.9	13.9	13.9	13.9	13.9

Interest on operating capital	0.5	0.4	0.4	0.3	0.3
Total operating costs	25.1	22.9	21.4	20.3	19.5
Cash overhead costs	1.3	1.1	0.9	0.8	0.7
Noncash overhead costs	30.5	24.4	20.3	17.4	15.3
Total costs	56.9	48.3	42.6	38.5	35.4
Harvest percent of total	24%	29%	33%	36%	39%

1/ Includes picking ($0.11/lb) and hauling costs.
Source: Oregon State University Extension Service, EM 8479.
Note: Costs for 16,000 pound yield were given, remainder calculated by ERS.

Table 13--Costs of producing sweet cherries: Northern San Joaquin Valley, California, 1989

Item	Yield (pounds per acre) 4,400	6,600	8,800	11,000	13,200
	-Cents per pound-				
Cultural cost	19.4	12.9	9.7	7.8	6.5
Harvest cost 1/	22.3	22.3	22.3	22.3	22.3
Total operating costs	41.7	35.2	32.0	30.0	28.7
Cash overhead costs	4.5	3.0	2.2	1.8	1.5
Noncash overhead costs	46.7	31.1	23.3	18.7	15.6
Total costs	92.8	69.3	57.5	50.5	45.8

Harvest percent of total 24% 32% 39%
44% 49%

______________1/ Includes picking ($0.15/lb to picker, $0.06/lb to contractor) and hauling costs. Source: Agricultural Economics Extension, University of California, Davis.

Maturity and cosmetic standards are somewhat less exacting for processing than for fresh use. Hence smaller-sized and mechanically harvested cherries can be used for processing. Since the mid-1980's, nearly all Michigan cherries have been mechanically harvested and Maturity processed. In contrast, most of Oregon's brined cherries were hand-picked with the stem in place and used to make high quali cocktail-style, maraschino cherries.

Packing and Shipping

Cherries are highly perishable, so immediate and continuous cooling to slow respiration and retard moisture loss is essential after harvest. In the field, containers are kept out of the sun and ofte covered with moist canvas or polyethylene and cardboard. Trucks that are closed and cooled, or at least covered, are used to transport cherries to packing facilities (Fogle). For the best results, cherries should be delivered to the packing house no more than two hours after picking (Scott).

Cherries can be pre-cooled to remove field heat before sorting and packing by placing boxes or bins newly-harvested cherries in cold-storage rooms at 36° F - 40° F overnight. Another precooling metho uses a hydro-cooling system installed along the packing line to shower or submerge cherries in cold water. These systems lower fruit temperatures to at least 50° F before the cherries are packed (Scott).

Fresh-market sweet cherries are sealed in polyethylene bags in 12-, 18-, or 20-pound lugs. Packed cherries are cooled overnight, usually with a forced-air system, to bring fruit temperature down clo to 32° F before shipping. Sweet cherries in sealed bags can usually be held at 31° F - 32° F for 2 weeks after harvest without quality degradation. When moved to higher temperatures, the bags shoul opened to prevent the accumulation of carbon dioxide and oxygen depletion that accelerate fruit deterioration (Fogle).

USDA size standards for sweet cherries are based on row size, which refers to the number of fruit of the same size, placed shoulder to shoulder, needed to cover ten and one-half inches, the width of a standard shipping container. Row size and fruit diameter are inversely related: for 9-row size, the cherry diameter is 73/64 (1.141) inches; for 10-row size, 65/64 (1.016) inches; 11-row, 59/64 (0.922 inch; 12-row, 54/64 (0.844) inch; and 13-row, 50/64 (0.781) inch.

The federal marketing order for Washington sweet cherries requires that the diameter of fresh cherr shipped from Washington be within 10 percent of these minimums. Traditionally, 12-row size and larg cherries have been sold in 20-pound cartons, while smaller cherries were sold in 12-pound cartons. Recently, Washington raised the minimum to 12-row size from the 13-row size (McFarland).

Table 14--Usual bloom and harvesting dates for sweet cherries

	Usual dates of	Usual harvesting dates

State	full bloom	Begin	Most active	End
California	Mar. 15-Apr. 10	May 5	May 22-Jun. 25	Jun. 30
Colorado	Apr. 20-Apr.30	Jun. 20	Jun. 25-Jul. 10	Jul. 15
Idaho	Apr. 10-Apr. 30	Jun. 20	Jun. 25-Jul. 10	Jul. 15
Michigan	Apr. 25-May 20	Jun. 25	Jul. 1-Jul. 20	Jul. 30
Montana	May 10-May 20	Jul. 20	Jul. 25-Aug. 10	Aug. 15
New York	Apr. 20-May 15	Jun. 15	Jun. 25-Jul. 10	Jul. 15
Oregon	Apr. 5-May 10	Jun. 10	Jun. 15-Aug. 5	Aug. 10
Pennsylvania	Apr. 20-May 10	Jun. 10	Jun. 20-Jul. 5	Jul. 10
Utah	Apr. 15-Apr. 24	Jun. 10	Jun. 15-Jul. 15	Jul. 20
Washington	Apr. 10-Apr. 25	Jun. 10	Jun. 15-Jul. 10	Jul. 15

Source: USDA, Statistical Reporting Service.

Note: Dates reported in this table may differ slightly from those reported in the "State Analyses" section. Dates in that section largely reflect personal communication with extension specialists and ASCS county executive directors and may be more location-specific than the dates in this table.

Processing

Processing provides an outlet for smaller-sized cherries that are not suitable for the fresh market. About 50 percent of U.S. sweet cherry production in 1991-94 was processed. Of total use (fresh and processing) over the 1991-94 period, 35 percent was brined for maraschino or glace cherries, and 6 percent was canned (USDA, NASS). The remainder was frozen, dehydrated, pickled, or blended with sour cherries to make juice, cider, and wine. Cherry cider or wine is pressed from fruit after fermentation (Fogle).

Brining

Brining is a process to preserve, change the texture, and remove the color of sweet cherries by packing them in a solution of sulfur dioxide (SO_2). It is the first step in the process of making maraschino cherries. Mechanically-harvested fruit without the stems can be used. Harvest-time is no less critical for brining than for fresh use because cherries picked too early will be harder to pit and those picked late will be softer and have more blemishes.
Cherries must be submerged in the brining solution and the containers covered to prevent vaporization of SO_2. Brined cherries are stored in wooden tanks, in bulk boxes designed for stacking and palleting, or in pits dug out and lined with heavy plastic sheets. Wooden boxes lined with heavy paper and thick polyethylene film can be used for brining in the field. Secondary bleaching is sometimes used for better decolorization of dark cultivars, as well as removal of browning caused by blemishes. Sodium hypochlorite, acetic acid, hydrogen peroxide, and sodium chlorite are bleaching agents.

The maraschino finishing-process begins after 4 to 6 weeks of brining. The cherries are removed from the SO_2 brine, rinsed with water, pitted and stemmed (cocktail-style are not stemmed), and then either returned to the brine for transport to a finisher or leached in running water for 24 hours to completely remove SO_2. Color, flavor, and sweetness are added in several steps that involve heating, cooling, rinsing, and soaking. The finished cherries are packed while still hot in heavy syrup and sealed in glass jars.

Manufacture of glace cherries is a variation of the maraschino process. The syrup penetration process is repeated several times using heavier and heavier syrups. After being held in the heaviest syrup for an extended period, the cherries are dried with a thin coat of syrup on them.

Most states use "U.S. Standards for Grades of Sulfured Cherries" (published by USDA in 1951), or slightly modified versions, for grading. The highest-quality cherries are U.S. Grade A (Fancy), followed by U.S. Grade B (Choice), and U.S. Grade D or "seconds." Most briners offer manufacturers a combination of Grades A and B, which indicates that 90 percent of the cherries are reasonably well-colored and free from misshapen fruit or blemishes, and that at least 50 percent have good color. All must be mature cherries from similar cultivars that are clean, firm, and well formed.

Canned

Sweet cherries may be canned with or without pits. Stems are always removed and they are thoroughly washed before processing. Canned cherries are graded by size according to diameters ranging from 20/32- to 23/32-inch, 26/32- to 28/32-inch, and 33/32-inch. The syrup of canned sweet cherries may contain up to 35 percent sugar.

Frozen

Frozen sweet cherries are pitted and packed with 1 part of dry sugar to 3 or 4 parts of cherries. Most frozen cherries are tart cultivars, but some sweet, dark varieties, such as Bing and Black Republican, are frozen for commercial distribution (Fogle).

Marketing Channels

Most growers market sweet cherries through a packer-shipper or a processor. Michigan growers are more likely to have their own brining facilities than growers in Oregon, where most processing facilities belong to a grower cooperative. Large growers in Washington and California are likely to have facilities for packing, cooling, and shipping their own fruit, and may handle fruit for smaller growers. Cooperative packing houses are common in the Wenatchee area of Washington. Growers and handlers support several organizations that provide research, enforce grading standards, and promote fresh sweet cherries in domestic and export markets.

Production Perils

The most common production perils affecting sweet cherries include rain near harvest-time and freezing temperatures. Sweet cherry buds are especially susceptible to spring frosts during a period of time before the blossoms are fully open. The fruit are subject to disease infestations, as well as insect, bird, and rodent abuse.

Rain

Rain cracking is a major problem for sweet cherry growers. Cracked cherries are susceptible to fungal infection and the fruit is not marketable. Sweet cherries are most susceptible to cracking during and just prior to harvest. Rain drops striking mature cherries will frequently cause the skin to split or crack. Cracking results from direct absorption of water through the fruit skin, not from excess soil moisture absorbed through the roots (Pattersen).

Cracking is most likely to occur when long, slow, warm rains are followed immediately by sunshine. Cracking is less likely if the rain lasts for less than three hours, if temperatures remain cool until the fruit dries, or if wind dries the fruit quickly. Soft-fleshed cultivars are the least susceptible to rain cracking. Some firm-fleshed cultivars (Van, Sam, Hedelfingen) are more resistant than others. Rainier and Napoleon (Royal Ann) are moderately susceptible, while Bing and Lambert cherries are highly susceptible to cracking (Fogle).

Spraying with various wetting agents and combinations of calcium chloride, Giberellic acid, and calcium hydroxide were found to reduce cracking in the Pacific Northwest (Pattersen). Some types of sprays that were tried to prevent cracking left undesirable residues. Lime sprays were suggested only for fruit to be brined (Fogle). Treatment to prevent rain cracking does not seem to be a common practice among growers.

Frost and Freeze

Freezing temperatures are the second most important threat to sweet cherry output. Late spring frosts and early fall freezes can destroy sweet cherry buds and trees. Fruit buds are particularly sensitive to spring frosts just preceding and during the opening of flower clusters. Other stone fruit may tolerate temperatures as low as 25° F during the tight-cluster stage of flower opening, but 28° F is the critical minimum temperature for cherries. Later, during full bloom and after, cherries can tolerate cold as well as can other fruit that are at the same stage of development (Fogle).

When fully dormant, cherry trees can withstand lower minimum temperatures than peach and pear trees, but are susceptible to fall freezes that occur before the hardening process is complete. Freeze damage to trunk and limb joints can be severe if the tree is not dormant. Once dormant, the sweet cherry tree can tolerate temperatures as low as 0° F.

Sweet cherry buds are very susceptible to cold damage and, for that reason, trees are planted on the highest ground available since the coldest air moves to the lowest elevations. When cold temperatures are expected, growers can use orchard heaters, wind machines, and irrigation for protection. Irrigation water, even if supplied by under-the-tree systems, can raise the air temperature by several critical degrees.

Protection against cold damage can also raise other potential problems. For example, while a fall irrigation may help protect the crown and root area from winter damage, some sources indicated it reduces the cold tolerance of fruit buds. In addition, if propane heaters are used to protect from cold damage, they can result in fire if used in orchards with an accumulation of vegetative debris and/or on slopes.

Excessive Heat - Fruit Doubles

Unusually warm weather during the fruit bud initiation period (in the spring of the year preceding blossoming), has been associated with the increased occurrence of fruit doubles. Fruit doubles, or twins, occur when two pistils form on a single pedicle. If both are fertilized and develop normally, two fleshy fruits ripen on the same stem. If one of the twin fruits does not develop normally, it becomes a dry, hard protuberance that cannot be removed without harming the attached fruit. If not culled during harvest, the abnormal twin can puncture good fruit in the picking container. Excessive doubles can make sorting impractical and the crop unmarketable (Fogle).

Limiting orchard site choices to areas not prone to excessive heat reduces the incidence of fruit doubles. A dense cover crop can help moderate orchard temperatures. Excessive heat in California's interior valleys prompted the replacement of Bing with Early Burlat, a newer variety that is less prone to doubling (Grant).

Hail

Hail damage to cherries is of more concern in Michigan and other eastern states, where it is more common, than in the major western cherry-producing states. In addition to bruising the fruit, hail can shred foliage and remove the fruit buds for the following year's crop. Hail damage is usually not widespread, but occurs in small, localized areas.

Wind

Wind can interfere with pollination and reduce fruit set by prematurely removing blossoms and discouraging bee activity. In addition, the fruit can be bruised or scratched from rubbing against branches. Wind bruising is more problematic with tart than sweet cherries in Michigan (Ricks). Poplar trees are sometimes used as windbreaks in Pacific Northwest orchards (Watson).

Diseases

Sweet cherries can be damaged by several types of air-borne fungal diseases: brown rot, cherry leaf spot, Coryneum blight, powdery mildew, and Cytospora canker. Diseases caused by soil-borne fungi, such as armillaria root rot, verticillium wilt, and collar rot can be problems in some areas. Conditions that encourage fungal growth include excessive rainfall, cool weather, and poor drainage. Bacterial canker is a threat in all cherry-producing states and buckskin has caused damage in California. Viral diseases can usually be avoided by the choice of high-quality nursery stock.

<u>Brown Rot</u>

Brown rot is a major fungal disease of sweet cherries because it can damage blossoms, leaves, shoots, and fruit. Blossom infection is the most serious in areas with heavy spring rainfall, while fruit infection would be more likely in areas that receive summer rains. The brown-rot fungus can penetrate fruit, but usually enters through wounds or cracks, and rain-cracked fruit is ideal for infection. Infected fruit that remains on the tree will shrink to become "mummies," which can be a source of infection. Brown rot can greatly reduce the marketable crop and, if symptoms do not appear until after harvest, can spread to other fruit in the processing and shipping stages. The use of protective sprays early in the season can reduce damage at all stages of development (Fogle).

Cherry Leaf Spot

Cherry leaf spot is caused by an air-borne fungus. The fungus enters young leaves when spores that overwinter in leaf debris are transported by wind. Small purple areas appear on the upper leaf surface and white spots appear on the lower surface. Cherry leaf spot can cause foliage loss of from 5 to 90 percent with an associated fruit yield reduction, as well as girdling of the fruit pedicel and subsequent fruit drop. Severely infected trees frequently go into dormancy without adequate food reserves and are more susceptible to winter injury. Chemical sprays are the recommended control in the case of severe defoliation (Fogle). Cherry leaf spot is more problematic in Michigan than in the western states (Nugent).

Cytospora Canker

Cytospora canker (also known as perennial canker and Valsa canker) is caused by two closely related fungi, *Cytospora cincta* and *Cytospora leucostoma*, that can infect wounds caused by breakage or improper pruning. Symptoms are depressed areas, with well-defined borders, on the bark of main leaders and branches. The most obvious canker symptom is a profusion of gum from canker wounds. When a trunk or limb is girdled by a canker, the area above the girdle will usually die (Fogle). The most effective treatment for canker is pruning and burning the affected wood (Grove).

Coryneum Blight

Coryneum blight is caused by the fungus *Coryneum beijerinckii* and consists of small elliptical cankers on twigs and small spots on leaves and fruit. The spots can coalesce, resulting in large brown lesions on fruit or holes in the leaves. Pruning out and burning twig cankers, in addition to spraying fruit and foliage with fungicide, provide the best control (Grove).

Powdery Mildew

Powdery mildew can be triggered by high humidity and above-normal night temperatures. The fungus *Podosphaera oxyacanthae* is responsible for powdery mildew infections of cherry fruit and foliage. Leaves may be curled or slightly blistered. A white, moldy growth is sometimes visible on the leaf or fruit surface. Infected fruit may show only a superficial water-soaked area. Sulfur spray is used to prevent powdery mildew in the West, but is not effective as a treatment after the mildew is established (Grove).

Armillaria Root Rot

Armillaria root rot is a serious threat to cherry trees in Michigan. The fungus attacks tree roots and, once established, has been maintained on old root fragments for 15 years. When newly-planted tree roots come in contact with infected roots, the disease reappears. Leaves of infected trees are small, pale, curled, and eventually wilt. Affected trees usually die within a year from the time symptoms appear, and adjacent trees are also likely to be infected.

Soil fumigation with carbon disulfide has been effective on California's light sandy soils, but it is difficult to get the fumigant deep enough to penetrate infected roots. Cherry orchards should not be established in areas that have been infected with armillaria root rot or where deciduous trees were cleared.

Verticillium Wilt

Verticillium wilt is caused by a soil-borne fungus, *Verticillium dahliae*, that finds susceptible hosts among many annual crops, as well as weeds and fruit trees. It can be a problem in western fruit-growing regions. Usually only one or two major limbs of the cherry tree will be affected, and they will have small leaves or poor terminal growth. Trees are not usually destroyed, but yields are lowered.

The best preventive measures against Verticillium wilt are: not planting susceptible annual crops (such as tomato, potato, cucumber, pepper, cotton, and strawberries) near orchards, removing host weeds, and avoiding planting in previously-infected areas. Some rootstock are resistant (Fogle).

Collar Rot

Collar rot is caused by the *Phytophthora* and *Poria* organisms that infect roots and destroy bark around the trunk at ground level. Waterlogged soils favor infection by Phytophthora and, unlike with armillaria root rot, infected trees may occur singly in orchards. Poria infections can occur even in well-drained soils. Reducing the amount of time that soil near the trunk is saturated will help prevent collar rot. Tree loss due to collar rot is minimal in most areas (Fogle).

Bacterial Canker

Bacterial canker infection can begin in blossoms and spread to the twigs and spurs. Cankers develop as sunken lesions on the trunk and small tree limbs during the fall and winter. The lesions usually occur at the base of an infected spur and spread up and down the trunk. Cankers caused by bacterial infection have the same symptoms and require the same control measures as those caused by fungi.

Infection of blossoms, commonly referred to as "blast" due to its appearance, occurs infrequently. Bacterial canker infection of cherry leaves starts as dark-green, water-soaked spots and progresses to cause a shot-hole or tattered appearance. On fruit, infected areas on fruit appear dark-brown or black and may have underlying gum pockets.

Control measures, including spraying, are effective for infection of leaves and blossoms, but are not effective once canker lesions have appeared

(Fogle). Some sweet cherry cultivars are more resistant to canker than others, but none are immune. Copper-sulfate sprays are applied when the trees are dormant to control bacterial canker in most cherry-growing areas.

Buckskin

Buckskin is a bacterial disease more prevalent in California than any other state. Affected cherries become a dull-white color, resembling buckskin, and fail to develop their normal size, sweetness, and flavor. The most effective control of buckskin is exercised by pruning all affected wood and grafting with a resistant scion (Grant).

Viral Diseases

Viral diseases are usually not a cause of tree collapse and death, but are more often debilitating. Viruses can drastically reduce yields by reducing fruit set, size, and quality, as well as delaying maturity and increasing the percentage of culls. Affected trees cannot be cured and usually have infected other trees by the time they are discovered. Infected trees should be removed immediately.

Some of the most common and damaging viral diseases of sweet cherries are: X-disease, little-cherry, Albino cherry, rasp leaf, rugose mosaic, ugly fruit, rusty mottle, twisted leaf, and short-stem virosis. Careful propagation and selection of nursery stock are the best ways to avoid viral infection (Fogle).

Insects

Pests of sweet cherries include cherry fruit flies, plum curculio, San Jose scale, shot-hole borers, mites, and lepidopterous larvae. Most pests can be controlled by insecticidal sprays, as long as the effective ingredients are available.

Fruit Flies

Fruit flies can be a problem for cherry growers everywhere. Late-season cultivars usually sustain greater injury than early varieties. Fruit fly infestations will cause processors to condemn an entire crop and exporters to reject shipments. The larvae of eastern, western, and black cherry fruit flies tunnel through the cherry to the pit and destroy the flesh.

Flies deposit eggs through slits in the skin of ripening cherries. Eggs hatch in 5-8 days and the larvae feed there for about two weeks before dropping to the ground and entering the soil for the winter. If inhabited cherries do not drop, larvae present in the harvested fruit become a threat in the fresh and processing markets. Prevention and control are achieved through an active insecticide spraying program (Fogle).

Plum Curculios

Plum curculios damage cherries first by puncturing the fruit to lay eggs. The larvae then feed on the flesh. Damaged fruit is scarred, misshapen, and worthless. If injured cherries do not drop, larvae present in harvested fruit become a threat in the fresh and processing markets. Curculios overwinter as adults in protected places. They emerge in the spring and feed on leaves and buds until fruit is present. They attack apple, peach, and plum orchards east of the Rockies, but can be controlled by insecticide spray (Fogle).

San Jose Scale and Shot-Hole Borers

San Jose scale and shot-hole borers attack the bark on the trunk and branches of cherry trees. Severe infestations can kill trees. Spraying infected trees during the dormant season usually controls scale in Washington. Keeping trees healthy and destroying damaged or infected trees or branches will discourage borers. Whitewashing trunks to prevent sunburn and spraying insecticides, as needed, are also recommended to protect tree bark.

Mites

Mites are tiny, sucking pests, that thrive in dry conditions. Leaves attacked by mites become bronzed or brown and dry. If damage is severe, leaves drop prematurely and the size and quality of next season's fruit is reduced. Mites are less likely to reach outbreak proportions on cherries than other deciduous fruit. When mites appear, a suppressive-type spray program after harvest usually provides sufficient control (Fogle).

Lepidopterous Larvae, Fruit Tree Leaf Rollers, and Leaf Hoppers

Lepidopterous larvae, fruit tree leaf rollers, and leaf hoppers damage buds and foliage of cherry trees early in the growing season and eventually feed on the fruit. They can usually be controlled by spraying or dusting with an insecticide before the buds open and again at petal fall (Fogle).

Birds and Rodents

Birds are a bother in all cherry orchards, although they are not usually held responsible for wide-spread crop losses. Bird depredation seldom causes significant yield losses in areas of large, concentrated commercial plantings, but can decimate small, isolated orchards. Flocking birds, such as starlings, can inflict considerable damage to sweet cherries. Robins, finches, sparrows, crows, ravens, magpies, and even sea gulls may be very destructive to small plantings. Methods for keeping birds way from fruit include: placing netting or cloth over the trees, noise-making or distracting devices, and trapping to reduce noxious bird populations (Fogle).

Burrowing rodents, such as gophers and meadow voles (similar to mice), disturb tree roots and can cause girdling by chewing on the bark at the base of cherry trees (Nugent). Gophers can become problems in dry areas of the West, where pesticide pellets are used to control their populations (Hinman).

Ad Hoc Disaster Assistance for Cherries

Ad hoc disaster assistance legislation was made available for losses of commercially-grown crops in each of the years 1988-93. 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 FCIC sweet cherry policy. These data may also suggest the areas where the demand for a sweet cherry crop insurance policy would be relatively high.

Under the 1988-93 legislation, payments were made under the categories 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 sweet cherries--were eligible for payments for losses greater than 40 percent of expected production. If a producer had no individual yield data to use in calculating "expected production," county-level or other data were used as a proxy. Payment rates for cherries were based on 65 percent of a 5-year average price, dropping the high and low years.

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 cherries between 1988 and 1993, regardless of the type of cherry.

In the aggregate, payments for cherry losses (all types) totalled over $26.0 million between 1988-93 (Table 15). Payments for cherry losses peaked at $8.5 million in 1988, and were at $6.0 in 1991. In 1989 and 1990-92, payments were less than $3.7 million. Payments for cherry losses were scattered over a geographically broad area (Figure 6). Twenty-four states received payments in at least one of the six years, encompassing 167 counties.

In an ordering of counties, Yakima County, Washington ranked first in payments for cherry losses, receiving about $5.8 million over the 6-year period. The next three counties in the series include: Benton County, Washington ($2.6 million); Oceana County, Michigan ($1.6 million); and San Joaquin County, California ($1.0 million). Six of the top-10 counties were in Michigan, three were in Washington, and one was in California.

By state, the largest payments were made to Washington growers, at $10.5 million over the six-year period. Michigan growers received $8.3 million. Other states receiving large payments include Oregon ($2.7 million) and California ($1.7 million). In total, Washington received 40 percent of the payments made for cherries over the six-year period, and Michigan received about 32 percent.

Disaster payments averaged 2.2 percent of the cherry value of production over the 1988-93 period (Table 15). Disaster payments as a percent of crop value were highest in Montana and Idaho, and lowest in California, New York, and

Pennsylvania. The low payments in California, in particular, likely reflect the relatively limited severity of production perils in that state.

Using specific examples, California accounted for 15 percent of the value of U.S. cherries between 1988-1993, but received only 6 percent of the disaster assistance payments made for cherries. Ad hoc assistance payments amounted to less than 1 percent of the state's cherry crop value. Similarly, Oregon accounted for 18 percent of the value of U.S. cherries over the six-year period, and received 10 percent of U.S. disaster payments for cherries. These payments amounted to 1.3 percent of the value of the state's cherry crop.

In contrast, Michigan growers accounted for 24 percent of the cherry value of production in the U.S., and received 32 percent of the ad hoc payments for cherries. These payments accounted for almost 3 percent of the state's value of cherry production.

State Analyses

Washington

Washington is the leading sweet cherry-producing state and provides the largest share of U.S. fresh and canned sweet cherries. Bing is the major variety, and fresh use accounts for nearly two-thirds of production. Washington cherries are harvested in June and July. Rain cracking and freeze damage are the major production perils. Despite the high risks associated with sweet cherry production, there is likely to be only a small interest in crop insurance because Washington growers are able to manage risks by producing other fruit crops less susceptible to weather perils and by having off-farm sources of income.

<u>Industry Characteristics</u>

The 1992 Census of Agriculture reported 1,777 farms growing sweet cherries in Washington on 16,677 acres. The total area, including nonbearing-age trees, was up 8 percent from the 1987 Census. Twenty-five percent of Washington's farms with sweet cherries had sales of more than $100,000, a higher portion than in other states. Even so, 50 percent had sales of less than $25,000.

Although nearly 60 percent of Washington's growers considered farming their main occupation, 42 percent worked at least 100 days off the farm in 1987. Most cherry growers in Washington also produce apples and pears. Some grow apricots, peaches, hops, or asparagus. Those who do not have additional fruit acreage are likely to earn a substantial share of their income from off-farm sources (Pace-Opfer).

Washington accounted for 42 percent of U.S. sweet cherry production in 1991-94. The state provided about 52 percent of the U.S. fresh crop, about 42 percent of U.S. canned production, 21 percent of brined output, and nearly 53 percent of the U.S. output of dried, frozen, and other processed sweet cherry products.

Table 15--Sweet cherries: Cumulative crop value and disaster assistance in selected States, 1988-93

State	Total crop value	Total disaster payments	Disaster payments, percent of crop value
	------1,000 dollars------		Percent
California	180,047	1,695	0.9
Idaho	8,063	709	8.8
Michigan	287,899	8,331	2.9
Montana	1,795	921	51.3
New York	32,721	88	0.3
Oregon	208,666	2,735	1.3
Pennsylvania	20,707	18	0.1
Utah	30,744	339	1.1
Washington	411,421	10,527	2.6
Nine States	1,188,700	26,350	2.2

Source: Disaster payments from ASCS data files, compiled by the General Accounting Office. Crop values from USDA, NASS.

Washington cherries are grown and harvested primarily for the fresh market. Processing is a secondary outlet for fruit that fails to meet fresh-market grade standards. In 1991-94, fresh-market use accounted for 64 percent of Washington's sweet cherry production (USDA, NASS).

The average price for all Washington cherries was 56.4 cents a pound between 1991-94, higher than in Oregon but lower than in California. Oregon's average price is lower because a higher percentage of the crop is used for processing in that state. In contrast, California's cherries are mostly fresh marketed early, when prices are seasonally high. Between 1991-94, grower prices for Washington's processing cherries averaged about 40 percent of fresh market prices.

Sweet cherries are an important Washington crop in terms of over-all value and are the third leading tree-fruit crop. The value of Washington's sweet cherry crop was $88.7 million in 1994, down from $94 million in 1993 (Table 16). In comparison, Washington's apple crop had a value of $706 million in 1994, and pear output had a value of $220 million (USDA, NASS).

Sweet cherry orchards are located in central Washington, almost entirely in the arid region east of the Cascade Mountains. The major production areas are the Yakima Valley and along the Columbia River near Wenatchee (Watson). According to the 1992 Census of Agriculture, about one-third of the state's sweet cherry acreage was in Yakima County in south-central Washington, and 18 percent was in Benton County. Another 18 percent of the state's acreage was further north, near Wenatchee in Chelan County, and 9 percent was in Douglas County.

Cultural Practices

The Bing variety accounted for 75 percent of Washington's sweet cherry acreage in 1993 (Washington Agricultural Statistics Service). The remaining acres were composed of Rainier (nearly 9 percent), Lambert (nearly 6 percent), Van (6 percent), and other varieties, such as Lapin, Sweetheart, and Attica. Fresh cherry shipments generally correspond to the acreage distribution, allowing for a higher share of Rainier and Van processed. The 1994 fresh pack consisted of 80 percent Bing cherries, with Lambert accounting for 10 percent and Rainier accounting for 5 percent (McFarland).

An established orchard will likely have about 130 trees per acre, and an under-tree sprinkler irrigation system. An orchard may also have wind machines or orchard heaters. Trees are likely to be pruned in February. Cover crops grown on the strips between trees require about five mowings between May and September, and a fall herbicide application.

Annual sprayings generally include: a pesticide application in March, four pesticide applications for fruit flies in May and June (the two in June are usually aerial), and a copper sulfate application in October to control bacterial canker. Two fertilizer applications are recommended: 150 pounds (of 46 percent) nitrogen per acre in November and 120 pounds of nitrogen in March. As much as 40 acre-inches of irrigation water may be required in central Washington each year for frost protection and fruit development. Bee hives (2 per acre) are brought into the orchards in April to aid cross-pollination (Hinman).

Harvesting and Marketing

Washington sweet cherries are harvested by hand during June and July. There are 60-70 packing houses in Washington that handle sweet cherries along with other types of fresh fruit. Approximately 40 percent of the packing houses are owned by grower cooperatives. In the Wenatchee District, most packing houses are cooperatives, while in the Yakima District, most are individually- owned by large growers, who also pack fruit for other growers. There are several canneries and a drying facility in Washington, but the brining and freezing facilities used by Washington growers are in Oregon (Pace-Opfer).

The Northwest Cherry Growers organization has 2,500 members in four states: Washington, Oregon, Utah, and Idaho. It is funded by growers to promote sweet cherry demand. The organization does not market cherries for growers (Pace-Opfer). Most packing houses have a selling agent on their staff or have arrangements with a broker to market the packed cherries (Ophardt).

The Washington Cherry Marketing Committee was founded in 1957 to administer the federal marketing order approved for dark sweet cherries (McFarland). The Committee is composed of 5 handlers, 10 growers, and another 15 alternate members. The Committee has the authority to regulate factors that relate to the quality of cherries grown or packed in six counties: Benton, Chelan, Douglas, Grant, Okanogan, and Yakima.

In 1994, a federal marketing order similar to the one in existence went into effect for Rainier cherries. In addition, the minimum size-standard was changed to eliminate 13-row size cherries from the fresh pack. Handlers collect assessments from growers based on the packed weight of cherries to fund the regulatory and research activities of the Committee.

Production Perils

Winter and spring freezes appear to cause the greatest sweet cherry losses in Washington. The 1991 crop was severely reduced after buds were killed in December 1990, when the temperature dropped from 57^{o} to minus 27^{o} the next day. Rapid changes in winter temperatures are not uncommon in the state's cherry-growing areas, and growers generally use orchard heaters several times each year (Ophardt).

Other perils can also be important. Rain cracking can cause yields to fall dramatically. In addition to rain at harvest that can cause cracking, yields can be reduced by a poor fruit set due to wind, rain, and cool temperatures during pollination (Pace-Opfer).

Powdery mildew is probably the worst disease problem in Washington, and is triggered by high humidity and above-normal night temperatures. Sulphur spray is used for control. Bacterial canker and Coryneum blight can also usually be controlled by spraying. Verticillium wilt can be a problem for Washington cherry growers. Growers try to try to avoid planting sweet cherries on sites previously used for potatoes or other hosts of the Verticillium wilt virus (Ophardt).

Virus or virus-like diseases that are a problem in central Washington include: western X, little cherry, twisted leaf, rasp leaf, necrotic rusty mottle, and rusty mottle. Symptoms can appear suddenly and viral diseases can spread quickly. Although delayed fruit maturity and reduced tree growth and vigor are the only effects of viral diseases, lower tree vitality will reduce yields. Affected trees should be removed immediately (Mink).

Cherry fruit flies are a major menace to Washington sweet cherries. Infected fruit is not usually marketable since the fruit is not allowed to leave the state. Leaf hoppers, aphids, and San Jose scale can also be problematic but can be controlled by insecticides.

Demand for Insurance

Most of Washington's sweet cherry growers would likely participate in the catastrophic crop insurance plan because the expected benefits are relatively high compared with the cost of participating. Despite the perilous nature of sweet cherry production in Washington, demand for buy-up insurance is likely to be moderate because most producers grow other, more dependable fruit crops and many have off-farm sources of income Sweet cherries accounted for less than 30 percent of all commodity sales on farms growing sweet cherries, according to the 1987 Census of Agriculture. In addition, participation was rather low for the fruit-crop policies offered in Washington in 1992. Only 10 percent of the eligible apple acreage was insured in Washington, and only 2 percent of the pear acreage.

However, significant disaster payments were made to Washington growers for sweet cherry losses in each year between 1988 and 1993. During those years, Washington accounted for 35 percent of the value of U.S. cherry (sweet and tart combined) production, and the state received 40 percent of all U.S. cherry disaster payments.

Oregon

Oregon usually ranks second to Washington in sweet cherry production. While Washington provides mostly fresh cherries, Oregon supplies more cherries for processing uses (mostly for making maraschino cherries) than for the fresh market. Royal Ann is the major variety, with production concentrated in a small area called The Dalles in Wasco County in north-central Oregon.

Rain cracking and freeze damage are the major production perils. Despite the high risk of sweet cherry production, interest in crop insurance is moderate because growers are either very large, or they are very small with off-farm sources of income.

Table 16--Value of sweet cherry production, selected states, 1984-94

States	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	1,000 dollars										
Washington	40,654	36,527	59,437	68,332	60,918	67,390	62,602	51,580	74,895	94,036	88,700
California	25,569	24,641	10,211	28,615	20,040	24,418	19,610	34,434	38,342	43,203	63,512
Oregon	14,489	16,761	25,187	37,248	38,820	27,530	25,752	31,785	45,131	30,349	27,830
Michigan	13,120	15,500	11,520	18,436	18,395	11,705	6,913	14,097	11,708	18,717	13,497
Utah	1,881	1,624	1,509	1,181	1,505	1,280	871	700	2,037	1,149	2,030
Pennsylvania	1,098	655	1,270	1,036	1,512	975	81	1,530	1,653	1,562	1,656
Idaho	1,105	2,065	1,971	1,259	2,056	1,903	1,720	203	1,073	1,108	1,695
New York	1,248	1,005	1,008	909	1,042	924	520	1,081	498	595	697
Montana	932	2,255	480	2,280	1,042	1/	250	1/	336	167	770
United States	100,096	101,033	112,593	159,296	145,330	136,125	118,319	135,410	175,673	190,886	200,387

1/ No commercial production due to frost.

Source: National Agricultural Statistics Service, USDA.

Industry Characteristics

The 1992 Census of Agriculture reported 1,112 farms growing sweet cherries in Oregon on 12,832 acres. The total area, including nonbearing-age trees, was down 5 percent from the 1987 Census. Most of Oregon's sweet-cherry growing operations were quite small. In 1987, 72 percent had commodity sales of less than $25,000 and nearly 50 percent of the operators worked at least 100 days off the farm.

Oregon produced 23 percent of U.S. sweet cherry output in 1991-94, providing nearly 13 percent of U.S. fresh production and 34 percent of processing production. The average price for processed cherries in Oregon is higher than in other states because Oregon produces premium, cocktail-style maraschino cherries.

The value of Oregon's sweet cherry crop was $27.8 million in 1994, down from $30.3 million the prior year. Sweet cherries are one of the state's most important crops. Pears are the only higher-valued fruit grown in Oregon (USDA, NASS).

Oregon's cherry-producing regions are in the north-central area (Wasco and Hood River counties) and in the Willamette Valley (Yamhill, Marion, and Polk counties) in western Oregon. From 1991 through 1993, Wasco County, in north-central Oregon, accounted for 64 percent of the state's sweet cherry output. Other counties each provided between 6 and 9 percent (Miles).

Wasco county's production is concentrated in a small area called The Dalles. Although cherries had been grown in the area since the late 19th century, output increased after The Dalles Irrigation District was established in the early 1960's (Seavert). Wasco County production rose from an annual average 25 million pounds in the 1960's to 53 million pounds in the 1990's.

Sweet cherry growers in Wasco and Hood River counties are more specialized and have more acreage than growers in the Willamette Valley. There are about 80 growers in The Dalles, but 15 of them provide 85 percent of the area's sweet cherry output (Bailey). In Wasco County, growers average about 80 acres of sweet cherries. Many have 300-400 acres, and several growers in The Dalles have 700 acres.

There are 6,000 acres of sweet cherries in Wasco County and fewer than 1,000 acres in other fruits, mainly pears and apples. Sweet cherry growers in the Willamette Valley are more likely to have apple or pear acreage, and to rely on non-farm income, than are growers in Wasco County (Long).

Cultural Practices

The main sweet cherry cultivars in Oregon are Royal Ann, a white variety that is mostly brined, and Bing, a variety produced for the fresh market. Van, Black Republican, and Rainier cultivars are planted mainly to provide pollen, but the fruit of these cultivars is canned, frozen, or brined (Long).

Most of Oregon's sweet cherry orchards have solid-set irrigation systems to augment rainfall during the growing season. Trees are typically planted 22 feet apart, resulting in approximately 90 trees per acre, of which about 80 trees are the main cultivar and 10 are pollinators. Trees are pruned to maintain a height of 14-15 feet. Some cherries are harvested the fourth year after planting, yielding perhaps as little as 1,000 pounds an acre. Yields may rise to 10,000 pounds by the eighth year (Seavers).

The sweet cherry production cycle begins with the application of fertilizer in March. Trees are in full bloom for about a week during the first two-and-a-half weeks of April. Two hives of honeybees per acre are brought in to aid pollination, which can be accomplished in two days of good weather. Weeds and excess vegetative growth between the trees are controlled with fall and spring herbicide applications, as well as about five mowings. Recommended cultural practices include five applications of insecticides during the growing season, plus a dormant application. Copper sprays to prevent bacterial canker are applied in the fall and/or early spring. Sulfur is usually sprayed twice in May to combat powdery mildew (Seavers).

Harvesting and Marketing

Royal Ann cherries mature during the first week of June. Bing cherries mature about two weeks later. Oregon's sweet cherry harvest usually lasts 5 to 6 weeks, and is completed by July 1. Harvest for an individual grower is more likely to be completed in 3 to 4 weeks. Although nearly 75 percent of Oregon sweet cherries are processed, only a small proportion are mechanically harvested. There is no mechanical harvesting in The Dalles and less than half of Willamette Valley cherries are mechanically harvested (Bailey). Sweet cherries are hand-picked, with the stem on, for fresh use and for premium, cocktail-style maraschino cherries.

Large growers in Wasco County are likely to have their own packing and/or brining facilities. The Oregon Cherry Growers cooperative is the main handler of sweet cherries in the state and receives 90 percent of The Dalles output (Long). The cooperative owns and operates fresh packing houses, as well as brining and freezing facilities. It also markets members' sweet cherries. A major Michigan maraschino manufacturer, Gray and Company, has facilities for brining in Oregon (Bailey).

Production Perils

Rain cracking is the major threat to Oregon sweet cherries. The period of risk for rain damage extends from mid-May to the end of harvest. However, cherries are most susceptible to cracking in the early stages of maturity (early June), and susceptibility declines as maturity advances. A slow, warm rain has the most potential for harm. Cracking may not occur after a short rain (3-4 hours). Damage can also be avoided if the cherries dry rapidly (Long). Wind machines (or helicopters) are used by Oregon growers to dry cherries after rain. If 40-50 percent of the fruit appears to be cracked, growers may decide not to harvest because the cost of hand picking is not likely to be recovered when the reduced-quality cherries are sold for brining.

Cold weather, either in the winter that damages flower buds (as in 1991) or in the spring when blossoms are susceptible, is another source of crop loss. Wind machines are used to prevent frost damage, along with orchard heaters and irrigation. Poor weather during pollination is another production peril.

Diseases and pests are under control and are responsible for minimal loss of sweet cherry crops in Oregon. Oblique-banded leaf roller infestations may be found 3-4 times a year. Cherries with leaf rollers or fruit flies are not acceptable for export to Japan and must be diverted to other markets (Long).

Demand for Insurance

Most of Oregon's sweet cherry growers would likely participate in the catastrophic crop insurance plan because the expected benefits are relatively high compared with the cost of participating. Buy-up participation, however, is likely to be limited to some of the larger commercial growers due to their specialization in cherry production. Six percent of Oregon's eligible apple acreage was covered by crop insurance in 1992. Participation in buy-up policies would probably at least equal participation in the apple policy.

The fact that a number of growers appear to specialize in cherries may boost insurance participation. An estimated 60 percent of all commodity sales reported by Oregon cherry producers in 1987 were from sweet cherry sales. Specialized farms have fewer opportunities to manage income risks through diversification than farms with a number of crops. Insurance provides an additional risk management tool to specialized operations.

Disaster assistance for Oregon cherries was relatively low, at 10 percent of 1988-93 payments, and amounted to less than 2 percent of the value of Oregon's sweet cherry production. However, recent experience with losses due to rain may boost buy-up participation in cherry insurance. Rain at harvest is not common in The Dalles, but the 1994 crop was the most rain-damaged in the last 30 years (Bailey).

California

California primarily produces Bing cherries for the fresh market and has the earliest cherries on the market in the spring. Production is centered in the northern San Joaquin Valley, where spring rains and frost occasionally cause cherry losses.

Industry Characteristics

The 1992 Census of Agriculture reported 1,130 farms growing sweet cherries in California, on 16,228 acres. The total area, including nonbearing-age trees, was up 33 percent from the 1987 Census. San Joaquin County had 65 percent of the acreage. Most cherry-growing operations in California were small, with

62 percent having sales of less than $25,000. California, however, had a higher proportion of large cherry farms than any other state--6 percent of farms with sweet cherries had sales of at least $500,000.

California produced nearly 20 percent of U.S. sweet cherry output in 1991-94, providing 30 percent of the U.S. fresh crop and 10 percent of U.S. processed output. The value of California's sweet cherry crop was a record $63.5 million in 1994 . Sweet cherry is not one of the most valuable crops produced in the state nor in San Joaquin County, where grapes, almonds, walnuts, and tomatoes accounted for a higher value of production in 1993. California typically produces fruit, nut, and berry crops valued at more than $5 billion (USDA, NASS).

Cherries that fail to satisfy California's strict size and condition standards for the fresh pack can usually be sold for processing, particularly brining. Between 1991-94, an average 75 percent of the state's production went to the fresh market and 25 percent was processed (USDA, NASS).

Nearly 75 percent of California sweet cherry output originated in San Joaquin County in 1992. The remainder of the crop was from Stanislaus County (15 percent), Santa Clara County (6 percent), San Benito (less than 3 percent), Contra Costa (less than 2 percent), and five other counties that each produced less than 1 percent of the state's output (Appendix table 6).

Cultural Practices

Bing is the predominant sweet cherry variety grown in California, followed by Burlat, Rainier, Larian, Tulare, Brooks, Garnet, Early Bing, King, Lambert, and Van. Bing accounted for 91 percent of fresh-market shipments reported by the California Cherry Advisory Board in 1994. Early Burlat and Rainier each accounted for almost 2 percent of total shipments. Tulare and Larian were each about 1 percent, and the other varieties accounted for less than 1 percent.

A typical sweet cherry orchard in the northern San Joaquin Valley has trees planted 22 feet apart, with approximately 90 trees per acre. Solid-set irrigation systems are typically used, with deep well water providing 32 acre-inches of water a year. Irrigation is normally used between April and September, with the heaviest use in July and August. Herbicides are applied between the trees in November, and the area is mowed four times between April and September. Trees are pruned once a year and bees are brought in to aid pollination in March (one hive per acre).

The application of chemicals and nutrients depends on the condition of the orchard. A typical schedule consists of a dormant spray in January, a fungicide application during bloom and again before harvest, and a worm/foliar-nutrient spray applied in April. After harvest, sprays for leafhopper and mite infestations can be applied several times if needed. Fertilizer is applied in June, at a rate of 100 pounds of nitrogen per acre (Grant).

Harvesting and Marketing

Harvest of California's sweet cherry crop begins in late April and continues through early June. More than half of the crop is usually harvested during the last two weeks of May. The heaviest shipment volumes occur between the third week of May and the first week of June. California is usually the only state shipping fresh cherries in early May, when prices are seasonally high. During the 1991-94 seasons, prices for California fresh sweet cherries averaged 85 cents a pound, while the U.S. average was 71 cents.

Most of California's sweet cherries are handled by commercial packers rather than cooperatives. Blue Anchor, however, is one grower cooperative that packs sweet cherries and other fruit. A state marketing order for sweet cherries is administered by the California Sweet Cherry Advisory Board. The order authorizes the Board to collect grower assessments based on the quantity of cherries sold, and to conduct advertising and promotion in export and domestic markets (Culbertson).

Sweet cherries are an important export commodity in California. In 1994, nearly 40 percent of California's sweet cherry production was exported. Japan was the largest market, receiving 79 percent of California's exports; Canada received 6 percent; Taiwan, 7 percent; the United Kingdom, 3 percent; and, Hong Kong, 2 percent (Culbertson).

Production Perils

Major production perils include rain at harvest, which causes skin cracking, and excessive heat, which contributes to fruit doubling. Although most sweet cherries are grown in northern California, which has a suitably cool climate, high temperatures occur in parts of the interior valleys. Varieties such as Early Burlat, which are less prone to doubling than Bing, are planted in areas where excessive heat has been a problem.

Sweet cherries bloom relatively late in California (the first or second week of March), when losses due to late frost are diminished. Although freezing temperatures are less of a problem in California than in many other states, late-spring and early-fall freezes can limit output at higher elevations in the foothills.

Brown rot is a major fungal disease in California. It can severely damage the blossoms, shoots, leaves, and fruit of sweet cherry trees. Blossom infection is the most serious in areas where spring rainfall is high. Infected cherries can shrink and dry on the tree. Other fungal diseases, including root rot and crown rot, can also be a problem in California, but are less serious than brown rot (Grant).

Buckskin is a bacterial disease that is more prevalent in California than in any other state. Affected cherries become a dull-white color, resembling buckskin, and fail to develop their normal size, sweetness, and flavor. The most effective control of buckskin is pruning all affected wood and grafting with a resistant scion (Grant).

<u>Demand for Insurance</u>

Most commercial sweet cherry growers would likely participate in the minimum catastrophic plan for sweet cherries because of its low cost. There will probably be less interest in buy-up insurance among growers in California than in Washington and Oregon, because of the lower risks of weather-related losses. California received only 6 percent of U.S. cherry disaster payments between 1988-93, which amounted to less than 1 percent of their crop value. At the same time, California accounted for 15 percent of the value of U.S. cherry production.

Michigan

Michigan produces mainly light-colored sweet cherries that are processed to become the stemless maraschino cherries used in fruit cocktail. Sweet cherry growers also often produce tart (sour) cherries, apples, and plums. Usually, sweet cherry growers have more tart cherries than sweet cherries. Relatively high disaster payments indicate substantial production risks, and may indicate interest in crop insurance.

<u>Industry Characteristics</u>

The 1992 Census of Agriculture reported 933 farms growing sweet cherries in Michigan, on 12,336 acres. Grand Traverse County and Leelanau County in northwest Michigan had 65 percent of the acreage. The total area, including nonbearing-age trees, was down 2 percent from the 1987 Census, while the number of farms was down 7 percent. Although 55 percent of Michigan's sweet cherry-producing farms had commodity sales under $25,000, a relatively high proportion--43 percent--had sales in the $25,000-$500,000 range. Only 2 percent, however, had sales of $500,000 or more.

A state-wide survey showed that, in 1991, 56 percent of the growers had fewer than 10 acres of sweet cherries, 30 percent had 10 to 30 acres, 9 percent had 30 to 49 acres, and 5 percent had 50 acres or more. For most Michigan growers, sweet cherries are a secondary crop to tart cherries. Apples and plums are at times produced along with sweet and tart cherries (Ricks).

Michigan produced 13 percent of U.S. sweet cherry output between 1991-94. The state provided less than 2 percent of the U.S. fresh crop, but 24 percent of U.S. processed output. The value of Michigan's sweet cherry crop was $13.5 million in 1994. The per-unit value of the crop is lower than in other states due to a high proportion of processing use.

The average Michigan grower price for sweet cherries was 33 cents a pound over the 1991-93 period, compared to a 51-cent U.S. average. Sweet cherries are one of Michigan's most important fruit crops, in terms of over-all value, with apples, tart cherries, and blueberries typically of higher production value than sweet cherries (USDA, NASS).

Cultural Practices

For many years, Napoleon was the most widely-grown sweet cherry variety in Michigan. According to a 1991 survey, however, Napoleon cherries accounted for 1,840 acres, down from more than 3,000 acres in the early 1980's. At the same time, Gold cultivar area had grown to 2,100 acres (Ricks). Emperor Francis was the third most widely-planted variety, with 1,480 acres, followed by Schmidt (800 acres), Hedelfingen (680 acres), Sam (380 acres), Windsor (300 acres), and Rainier (260 acres). The top three varieties are light skinned, which are better suited to mechanical harvesting and brining. The dark sweet cherries (Schmidt, Hedelfingen, Sam, and Windsor) are canned or frozen.

Almost none of Michigan's cherry orchards were irrigated prior to 1970. Since the mid-1980's, however, nearly all newly-established orchards have drip or trickle irrigation. Water for drip irrigation is from low-capacity wells that were originally drilled to provide the water for cooling cherries following mechanical harvesting (Kesner).

Harvesting and Marketing

Michigan sweet cherries bloom in May and mature in late June or early July. Most are harvested in July. Nearly all of Michigan's sweet cherries are mechanically harvested and used for brining. From 1991 to 1994, 95 percent of Michigan sweet cherry output was processed, with 71 percent brined, 11 percent canned, and 13 percent frozen or otherwise processed. Just 5 percent of the last four crops were destined for the fresh market (USDA, NASS).

Most tart cherries and some sweet cherries used for brining are mechanically harvested directly into steel tanks of cold (45^{o} F to 50^{o} F) water (Kesner). Wooden apple boxes may also be used for sweet cherries, but the 18-bushel boxes are only filled two-thirds full to avoid crushing the fruit. Newly-harvested sweet cherries cannot be held in water tanks for extended periods because of the danger of skin cracking.

Harvested cherries are immediately placed in brining pits that have been lined with heavy plastic. Growers may dig their own pits or they may be provided by processors. Each load of cherries is graded before being placed in the brining pit. The initial grading determines the grower's price. Cherries are removed from the brine, graded, pitted, and then frequently placed in brine again for delivery to manufacturers (Nugent).

The brining industry in Michigan consists of 3 manufactures of maraschino and glace cherries--Gray and Company, Universal Flavor, and Aunt Nellie's Kitchen. There are 8-10 firms with canning and freezing facilities, including Cherry Growers, Inc., Coloma, and Peninsula Fruit Exchange. Grower cooperatives handle most of the freezing and canning volume. Most of Michigan's fresh-market cherries are sold to consumers from roadside stands. In addition, there are three large packer-shippers and some produce buyers that truck fresh sweet cherries to nearby city supermarkets (Nugent). USDA grades and standards are used for brining cherries. Michigan has no formal marketing order, but passed enabling legislation to authorize the Michigan Cherry Committee to collect grower assessments to fund research and promotion. Organizations involved in promotion activities include the Cherry Marketing Institute and the National Cherry Growers and Industry Foundation.

Production Perils

Freezing temperatures are the major hazard to Michigan sweet cherries. Spring frost in May, just before full bloom, causes more yield losses than early fall or hard winter freezes. Cherry trees can withstand Michigan's cold winters because they are quite cold-tolerant once established. When damage does occur, it is more likely to be damage to the wood than damage to the buds. Cherry buds are less susceptible to winter kill than are peach buds (Nugent).

Rain cracking is also a major problem in Michigan. Rain causes the skin of mature sweet cherries to split, with the greatest damage occurring to the most mature fruit. Rain within 10 days of harvest is likely to cause substantial damage, and even more damage if within 7 days of harvest. Cracking may also allow entry of the fungus that causes brown rot, making the crop unmarketable (Ricks). Unless more than half of the cherries are cracked, the crop is not likely to be abandoned. Cracked fruit will soon drop from the tree and the rest can be mechanically harvested.

In addition to brown rot, cherry leaf spot, and bacterial canker are perils to Michigan sweet cherry production. Preventative sprays are applied annually for all three diseases. Armillaria root rot, for which there is no effective treatment, can attack all the cherry rootstocks used in Michigan. The orchard must be moved to a new location (Nugent).

The most harmful insects are fruit flies and plum curculios, which can leave a worm in harvested fruit. Green fruit worms may damage the fruit, but are gone before harvest. Gophers are not a problem in Michigan, but meadow voles can damage trunks and roots.

Flocking birds (including starlings, grackles, and cedar wax wings) may cause severe damage to cherries. The cedar wax wing is commonly called the "cherry bird" in Michigan. Netting is recommended in small, isolated orchards to prevent bird depredation. In large plantings, the overall yield loss due to birds is likely to be insignificant (Nugent).

Demand for Insurance

Michigan growers are likely to participate in at least the catastrophic level of coverage. Participation in buy-up coverage may be higher in Michigan than in the other major production areas. Michigan growers appear to face more frequent losses due to rain cracking, frosts, and freezes than growers in other areas. The history of disaster assistance payments for cherries, which includes both sweet and tart cherries, suggests that Michigan has the largest losses among the major cherry states. While Michigan accounted for 24 percent of the value of U.S. tart and sweet cherry crops produced during 1988-1993, growers received 32 percent of U.S. cherry disaster assistance payments.

Another reason that Michigan growers may buy-up to higher coverage more frequently than growers in other states is that farms with sweet cherries in Michigan are less diversified with other crops. Although usually grown on farms with sweet cherries, tart cherries do not provide the same degree of risk reduction as some other crops because they are subject to many of the same production perils as sweet cherries. Frosts and freezes that reduce sweet cherry yields are likely to also reduce tart cherry yields on the same farm. However, rain cracking is less of a hazard for tart cherries than for sweet cherries.

Insurance Implementation Issues

Adverse Selection

Adverse selection in insuring sweet cherries is most likely to be associated with orchards located in areas subject to late spring frosts and freezes. Sweet cherries are quite prone to yield losses caused by frosts and freezes occurring just prior to, or during, the bloom period. The fruit buds are easily killed by cold temperatures at this stage in their development. Orchards located at lower elevations are more prone to freezing temperatures during the critical bloom period than orchards located at higher elevations.

A grower whose orchard is located in such a freeze-prone spot may be more likely to participate in crop insurance than growers as a group, particularly if the premium rate did not adequately reflect the risk of loss. Such a grower would expect to have more frequent, and more severe, yield losses than typical for growers in his area. If premium rates did not take such risks into account, his or her expected indemnity would exceed the total premium.

Setting Reference Prices

FCIC provides reference prices (price elections) for insured crops, which become the basis for assigning values to yield losses. Insured growers elect a percentage of this reference price in determining their insurance coverage.

FCIC may need to consider offering separate price elections for cherries that are declared a loss following harvest and for those that are declared a loss before harvest. Reference prices should be based on an in-field (on-tree) value for cherries declared a loss prior to harvest. Growers would not have incurred harvesting and marketing expenses for such cherries, and computing indemnities on the basis of the expected market price would reimburse them for non-incurred expenses. This could provide undue incentive for moral hazard, particularly during periods of low market prices. Examples of pre-harvest losses for which in-field reference prices seem appropriate include frost and freeze damage and severe rain cracking.

For cherries declared a loss following harvest, reference prices should be based on average market returns, perhaps with some adjustment for non-incurred packing and selling expenses. Growers would incur harvesting and grading expenses for damaged cherries discarded at the packing house. Moderate rain cracking, excessive fruit doubles, and fruit fly infestation are examples of losses where the cherries may be discarded following harvest.

There are two approaches for deriving an "in-field" reference price. One is to deduct the estimated harvesting, packing, and marketing expenses from the market price. Market price refers to the grower price and not the retail price. The second is to estimate the cost of production (exclusive of harvesting and marketing expenses) and use it as a proxy for the in-field price. Hand picking expenses accounted for 30-40 percent of total production costs in the western areas and nearly 50 percent in Michigan. Mechanical harvesting expenses amounted to 22 percent of total production costs in Michigan.

Market Prices and APH Distortions

Sweet cherry yields are measured by the quantity harvested and marketed rather than the quantity produced and potentially available for harvest. Because sweet cherries may be processed, low fresh market prices are not likely to have any appreciable effect on harvested yields. Despite the short season--the interval for harvesting high-quality fruit usually extends for only 7-10 days--and the perishable nature of the fresh fruit, growers are not likely to abandon undamaged cherries on the tree. In major production areas, growers usually have multiple uses for which they can sell sweet cherries--fresh, canned, frozen, and brined.

Estimating "Appraised Production"

One approach to estimating appraised production (harvestable, but unharvested yield) is to pick and weigh the potentially marketable fruit from a sample of plots and expand the plot yields to a per-acre basis. The plots would consist of randomly selected branches or sections of the tree from a sample of trees selected at random in the orchard. For immature fruit, the yields per plot would be estimated by counting the potentially harvestable fruit in the plots and multiplying by an average or typical weight.

Market Prices and Moral Hazard

Moral hazard is not expected to be an issue in offering crop insurance for sweet cherries in the major production areas. Moral hazard most often arises if the grower contributes to a yield loss by neglecting prudent management practices. Moral hazard is most likely to occur in circumstances where market returns fall below returns from an insurance indemnity.

When market returns fall below the insurance indemnity for some commodities, it is often because fresh market prices have declined and growers do not have an alternative market for their produce. With sweet cherries, however, market returns are typically expected to exceed insurance indemnities because growers have the option of selling to processing buyers.

Availability of Individual Yield Data

Although several state organizations collect assessments from growers based on their production, no source of individual acreage data was found. The County Agricultural Commissioners in California maintain lists of current growers in each county. They also maintain acreage records on growers who obtained permits to spray agricultural chemicals. They do not, however, have production data with which to estimate individual yield histories.

Demand for Insurance

Our assessment is that there would be widespread participation among sweet cherry growers in the catastrophic insurance plan because of the low cost of participation relative to the potential benefits. There is, however, likely to be much less participation in the buy-up plans than in the catastrophic insurance.

Participation in additional insurance coverage is likely to be greatest in Michigan, where growers face frequent losses due to rain cracking and to frosts and freezes. The history of disaster assistance payments for cherries, which includes both sweet and tart cherries, suggests that Michigan has the largest losses among the major cherry states. While Michigan accounted for 24 percent of the value of U.S. tart and sweet cherry crops during 1988-1993, growers received 32 percent of U.S. cherry disaster assistance payments.

Participation in buy-up insurance in Oregon and Washington is likely to be about the same as, or may slightly exceed, participation for apple insurance in these states. Ten percent of the eligible apple acreage in Washington and six percent of Oregon's apple acreage was insured in 1992.

It is our assessment that participation in a sweet cherry insurance policy would be lowest among growers in California. One basis for this judgment is their relatively low participation rates in programs for other crops. Just 5 percent of eligible stonefruit (apricot, peach, and nectarine) acreage was enrolled in 1993. While California cherries may be subject to more weather-related damage than other stonefruit, the risk of weather damage is lower than in other states.

The substantial disaster assistance paid for cherries in some of the minor states, such as Idaho, Montana, New York, Pennsylvania, and Utah, indicate that growers in these areas also may be interested in buy-up insurance. In most cases, however, the small acreage of sweet cherries grown in those states places a stringent limit on the amount of insurance likely to be sold.

Other Implementation Issues

The problems encountered in offering sweet cherry insurance would likely be about the same as those confronted with commodities such as apricots, peaches, nectarines, and plums, for which insurance is currently available. As with these fruits, sweet cherries are a perennial tree crop and frost and freeze damage are major sources of yield losses. Sweet cherries, however, have one additional important hazard. They are more likely to suffer yield losses due to rain cracking than other fruits, particularly in the more humid eastern production areas.

Insuring Trees

There may be an interest among growers in some areas in purchasing insurance for damage or loss of sweet cherry trees due to freezing or other hazards. Freezing temperatures were reported as a production hazard in Michigan and may be a peril in other areas. Although very winter-hardy once they become fully dormant, sweet cherries trees are susceptible to freeze damage before the hardening process is completed. In 1955, a number of cherry trees in the Pacific Northwest were killed or severely damaged by temperatures around 0° F in mid-November (Fogle).

The loss of a tree represents greater economic injury than the loss of fruit. A tree constitutes a long-term capital investment and its loss entails several years of foregone production, as well as the expense of establishing a replacement.

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Appendix table 1--Sweet Cherry Production: Major States and Counties, 1992

State and major counties	Total Farms	Total Acres	Total Trees	Harvested Trees	Harvested Farms	Harvested Pounds
California	1,130	16,228	1,517,200	1,125,593	714	61,412,592
San Joaquin	381	10,507	955,517	(N)	306	(N)
San Benito	14	616	40,187	29,461	10	1,667,290
Tulare	43	585	60,175	(N)	18	703,540
Contra Costa	32	510	63,564	45,374	20	876,104
Merced	11	338	32,194	13,302	8	893,938
Los Angeles	65	176	15,663	11,691	40	129,663
Stanislaus	63	(N)	(N)	(N)	41	3,667,545
Santa Clara	57	(N)	(N)	48,370	46	2,400,321
Other	464	3,496	349,900	977,395	225	51,074,191
Michigan	933	12,336	1,076,069	(N)	655	35,564,276
Leelanau	178	4,942	411,690	(N)	152	(N)
Grand Traverse	145	3,080	279,669	225,016	121	8,524,040
Antrim	48	1,265	113,616	93,417	42	3,816,112
Oceana	53	612	56,280	49,781	40	1,502,688
Other	509	2,437	214,814	(N)	300	21,721,436
Montana	188	927	73,480	42,987	85	(N)
New Mexico	177	163	13,601	7,956	87	152,958
New York	325	(N)	(N)	(N)	187	(N)
Oregon	1,112	12,832	920,497	789,509	757	96,155,078
Polk	101	2,368	173,710	143,383	86	11,501,477
Marion	138	1,607	122,197	108,843	95	11,350,354

Yamhill	113	1,124	62,049	58,469	77	7,839,185
Hood River	113	779	70,269	60,317	99	5,827,834
Umatilla	69	483	59,145	50,826	58	5,727,189
Wasco	102	(N)	(N)	(N)	99	(N)
Other	476	6,471	433,127	367,671	243	53,909,039
Pennsylvania	399	411	23,708	19,554	209	768,472
Utah	287	925	71,075	64,185	182	3,064,054
Washington	1,777	16,677	1,889,684	1,288,920	1,383	152,490,673
Yakima	535	5,603	602,979	(N)	476	61,748,124
Chelan	327	3,046	335,063	265,166	284	27,797,510
Benton	148	2,941	350,737	288,509	129	28,124,546
Douglas	273	1,522	167,421	108,754	214	8,203,390
Franklin	39	956	119,021	(N)	32	8,303,704
Okanogan	59	355	50,737	(N)	39	1,353,253
Grant	86	(N)	(N)	144,108	62	12,616,662
Klickitat	38	(N)	(N)	(N)	31	2,024,059
Other	272	2,254	263,726	(N)	116	2,319,425
These states	6,328	60,499	5,585,314	3,338,704	4,259	349,608,103
United States	7,191	63,065	5,782,321	4,610,836	4,603	357,485,535

(N): Indicates "not available" or "not published" to avoid disclosure. 1/ Trees of bearing age.

Source: 1992 Census of Agriculture.

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

State	All 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				
Washington	1,756	5	20	13	11	50
Oregon	1,215	1	11	9	7	72
California	886	6	14	8	10	62
Michigan	1,005	2	14	13	16	55
Utah	301	*	5	4	4	87
Pennsylvania	512	2	10	4	8	76
New York	350	2	20	12	8	58
Other	1,146	1	5	4	5	85
U.S.	7,171	3	13	9	9	65

Source: 1987 U.S. Census of Agriculture.

Appendix table 3--Principal occupation and number of days worked off the farm by operators of farms growing sweet cherries, by sales class, 1987

Item	All 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 of farms--------------				
Farming is main occupation						
Washington	1,044	82	318	173	129	342
Oregon	614	16	121	91	57	329
California	491	49	112	51	65	214
Michigan	638	17	131	113	123	254
Utah	140	1	13	12	10	104
Pennsylvania	281	9	47	19	32	174
New York	222	7	65	38	25	87
Other	509	12	47	43	39	368
U.S.	3,939	193	854	540	480	1,872
		------------------Percent of all farms-----------				
Washington	60	5	18	10	7	20
Oregon	51	1	10	8	5	27
California	56	6	13	6	7	24
Michigan	63	2	13	11	12	25
Utah	47	0	4	4	3	35
Pennsylvania	55	2	9	4	6	34
New York	64	2	19	11	7	25
Other	44	1	4	4	3	32
U.S.	55	3	12	8	7	26
		--------------------Number of farms--------------				
Operator days off-farm						
None						
Washington	749	60	238	123	79	249
Oregon	463	13	81	60	41	268
California	366	41	83	29	44	169
Michigan	435	12	105	71	74	173
Utah	117	1	12	6	3	95
Pennsylvania	208	9	38	16	26	119
New York	170	7	51	26	19	67
Other	404	12	39	30	28	295
U.S	2,912	155	647	361	314	1,435

Continued

Appendix table 3--Principal occupation and number of days worked off the farm by operators of farms growing sweet cherries, by sales class, 1987 continued

Item	Total value of crop sales: All farms	$500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number of farms					
Any						
Washington	918	29	97	95	105	592
Oregon	705	3	43	39	45	575
California	477	11	34	40	35	357
Michigan	529	3	33	50	80	363
Utah	166	0	2	4	7	153
Pennsylvania	292	1	9	5	13	264
New York	163	0	15	14	6	128
Other	692	1	14	11	24	642
U.S.	3,942	48	247	258	315	3,074
1 to 99 days						
Washington	166	10	36	22	24	74
Oregon	144	1	16	18	11	98
California	93	2	17	10	7	57
Michigan	131	3	18	28	25	57
Utah	21	0	1	2	2	16
Pennsylvania	60	0	6	3	4	47
New York	39	0	10	2	4	23
Other	103	1	6	5	9	82
U.S.	757	17	110	90	86	454
100 to 199 days						
Washington	177	6	18	13	31	109
Oregon	146	1	10	8	17	110
California	96	3	4	8	13	68
Michigan	113	0	7	10	21	75
Utah	33	0	0	0	3	30
Pennsylvania	55	1	3	1	3	47
New York	32	0	2	6	1	23
Other	172	0	2	6	6	158
U.S.	824	11	46	52	95	620

Continued

Appendix table 3--Principal occupation and number of days worked off the farm by operators of farms growing sweet cherries, by sales class, 1987 continued

Item	All arms	$500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
		Total value of crop sales				
		--------------------Number of farms-----------				
200 days or more						
Washington	575	13	43	60	50	409
Oregon	415	1	17	13	17	367
California	288	6	13	22	15	232
Michigan	285	0	8	12	34	231
Utah	112	0	1	2	2	107
Pennsylvania	177	0	0	1	6	170
New York	92	0	3	6	1	82
Other	417	0	6	0	9	402
U.S.	2,361	20	91	116	134	2,000
Not reported						
Washington	89	5	20	15	13	36
Oregon	47	1	9	8	2	27
California	43	3	8	4	6	22
Michigan	41	2	2	8	10	19
Utah	18	0	0	2	3	13
Pennsylvania	12	0	2	0	1	9
New York	17	0	3	4	3	7
Other	50	0	0	5	4	41
U.S.	317	11	44	46	42	174

Source: 1987 U.S. Census of Agriculture.

Appendix Table 4--Average Weekly Bing Cherry Price Distribution, f.o.b. California and Washington

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	Std
	$/pound												
May													
week 1									1.75	2.00			
week 2	0.67	1.11	1.39	1.51	1.67	1.81	1.68		1.38	2.05	2.06		
week 3	0.91	0.96	1.39	0.94	1.35	1.43	1.08	1.82	1.00	1.73	1.39		
week 4	0.69	0.94	1.11	0.81	0.93	1.10	1.06	1.88	1.02	1.45	1.05		
week 5											1.06		
June													
week 1		0.28		0.84	0.47	0.56		1.00			1.04		
week 2		0.54	1.04	0.75	1.15	1.04	1.15	1.33			0.83		
week 3	0.93	0.46	0.63	0.71	0.50	0.96	0.89	1.03	0.77	1.15	0.76		
week 4	0.71	0.90	0.70	0.78	1.00	0.60	0.90	1.28	0.63	0.80	0.92		
week 5								1.13	0.60	0.80			
July													
week 1	0.59	0.90	0.68	0.69	0.86	0.60	0.90	1.28		0.80	1.06		
week 2	0.53	0.98	0.93	0.65	0.61	0.68	0.90	0.91		0.95	1.10		
week 3	0.57	0.99	1.00		0.73	0.79	0.95	1.05		1.15			
week 4	0.60	1.00			0.75		1.00	1.24					
week 5	0.65												
Average	0.69	0.82	0.98	0.85	0.91	0.96	1.05	1.27	1.02	1.29	1.13		
	Percent of Average												
week 1									171	155	183	158	11
week 2	97	135	141	177	183	189	160		135	159	123	123	27
week 3	133	116	141	111	148	150	103	144	98	135	93	105	20
week 4	101	115	113	95	102	115	100	148	100	113	94	94	15
week 5		34		98	51	59		79			92	46	23

week 6		66	106	88	127	109	109	105			74	79	19
week 7	136	56	64	83	55	100	85	82	75	89	67	59	22
week 8	104	109	71	91	110	63	86	101	62	62	81	67	18
week 9								89	59	62		56	13
week 10	86	109	69	81	94	63	86	101		62	94	69	15
week 11	77	118	94	76	67	71	86	72		74	98	68	15
week 12	83	120	102		80	83	90	83		89		79	13
week 13	88	122			82		95	98				83	14
week 14	95												

Source: USDA, Agricultural Marketing Service and Economic Research Service.

Appendix Table 5--Bing Cherries: Weekly f.o.b. prices 1/, California and Washington, 1984-94 Continued

Date	CA	WA	Date	CA	WA	Date	CA	WA	Date	CA	WA
	--- $/pound ---			--- $/pound ---			--- $/pound ---			--- $/pound ---	
1984			1985			1986			1987		
May			May			May			May		
week 1			week 1			week 1			week 1		
week 2	0.67		week 2	1.11		week 2	1.3		week 2	1.51	
week 3	0.91		week 3	0.96		week 3	1.39		week 3	0.94	
week 4	0.69		week 4	0.94		week 4	1.11		week 4	0.81	
week 5			week 5			week 5			week 5		
June			June			June			June		
week 1			week 1	0.56	0.00	week 1			week 1	0.84	0.83
week 2			week 2	0.00	1.08	week 2	1.04		week 2	0.79	0.72
week 3	0.93		week 3	0.00	0.92	week 3	0.63		week 3	0.71	
week 4	0.71		week 4	0.90		week 4	0.70		week 4	0.78	
week 5			week 5			week 5			week 5		
July			July			July			July		
week 1	0.59		week 1	0.90		week 1	0.68		week 1	0.69	
week 2	0.53		week 2	0.98		week 2	0.93		week 2	0.65	
week 3	0.57		week 3	0.99		week 3	1.00		week 3		
week 4	0.60		week 4	1.00		week 4			week 4		
week 5	0.65		week 5			week 5			week 5		
1988			1989			1990			1991		
May			May			May			May		
week 1			week 1			week 1			week 1		
week 2	1.67		week 2	1.81		week 2	1.68		week 2		
week 3	1.35		week 3	1.43		week 3	1.08		week 3	1.82	
week 4	0.93		week 4	1.10		week 4	1.06		week 4	1.88	
week 5			week 5			week 5			week 5		
June			June			June			June		
week 1	0.93	0.00	week 1	1.12		week 1			week 1	1.00	
week 2	1.08	1.23	week 2	1.14	0.95	week 2	.12	.18	week 2	1.33	
week 3	0.00	1.00	week 3	1.28	0.64	week 3	0.88	0.91	week 3	1.03	
week 4	1.00		week 4	0.60		week 4	0.90		week 4	1.28	
week 5			week 5			week 5			week 5	1.13	
July			July			July			July		

week 1	0.86	week 1	0.60	week 1	0.90	week 1	1.28
week 2	0.61	week 2	0.68	week 2	0.90	week 2	0.91
week 3	0.73	week 3	0.79	week 3	0.95	week 3	1.05
week 4	0.75	week 4		week 4	1.00	week 4	1.24
week 5		week 5		week 5		week 5	

....

1992		1993		1994		
May		May		May		
week 1	1.75	week 1	2.00	week 1		
week 2	1.38	week 2	2.05	week 2	2.06	
week 3	1.00	week 3	1.73	week 3	1.39	
week 4	1.02	week 4	1.45	week 4	1.05	
week 5		week 5		week 5	1.06	
June		June		June		
week 1		week 1		week 1	1.13	0.95
week 2		week 2		week 2	0.84	0.82
week 3	0.77	week 3	1.15	week 3	0.67	0.85
week 4	0.63	week 4	0.80	week 4	0.92	
week 5	0.60	week 5	0.80	week 5		
July		July		July		
week 1		week 1	0.80	week 1	1.06	
week 2		week 2	0.95	week 2	1.10	
week 3		week 3	1.15	week 3		
week 4		week 4		week 4		
week 5		week 5		week 5		

1/ California container weight = 18 pounds, Washington = 20 pounds; 12-row size and Larger.

Source: USDA, Agricultural Marketing Service and Economic Research Service.

Appendix Table 6--California Sweet Cherries-Continued

County	Year	Harvested area	Yield per acre	Production
		Acres	------ Tons	--------
Contra Costa	1980	304	2.38	724
	1981	304	1.99	605
	1982	289	0.95	275
	1983	302	3.50	1,057
	1984	299	2.80	837
	1985	299	1.54	460
	1986	268	1.51	405
	1987	263	3.46	911
	1988	381	2.27	866
	1989	331	2.32	767
	1990	352	1.30	458
	1991	421	1.22	514
	1992	362	1.43	516
	1993	338	0.79	267
El Dorado 1/	1983	25	2.40	60
	1984	30	1.90	57
	1985	34	4.00	136
	1986	37	1.59	59
	1987	44	1.80	79
	1988	71	1.30	92

County	Year	Harvested area	Yield per acre	Production
	1989	80	2.00	160
	1990	93	0.32	30
	1991	103	0.70	72
	1992	110	2.00	220
	1993	115	0.05	6
Los Angeles 1/	1991	140	0.80	112
	1992	140	1.00	140
	1993	140	1.75	245
Riverside	1980	123	0.12	15
	1981	126	0.02	3
	1982	133	1.36	181
	1983	133	1.50	200
	1984	133	0.45	60
	1985	139	1.88	262
	1986	122	0.19	23
	1987	125	0.36	45
	1988	125	0.10	12
	1989	116	0.50	53
	1990	118	0.23	27
	1991	118	0.98	116
	1992	118	0.82	97
	1993	45	1.38	62
San Benito	1980	295	1.60	472
	1981	295	0.70	207
	1982	300	1.40	420
	1983	400	1.52	610
	1984	400	1.80	720
	1985	380	3.00	1,140
	1986	400	1.33	532
	1987	400	3.15	1,260
	1988	400	2.99	1,196
	1989	400	3.50	1,400
	1990	400	2.98	1,192
	1991	360	3.02	1,087
	1992	360	2.51	904
	1993	377	1.08	409

Appendix Table 6--California Sweet Cherries, cont.

County	Year	Harvested area	Yield per acre	Production
		Acres	-------Tons	--------
San Joaquin	1980	8,812	4.97	43,800
	1981	8,738	3.72	32,500
	1982	8,489	1.27	10,800
	1983	8,614	1.42	12,200
	1984	8,050	4.19	33,700
	1985	7,970	2.40	19,100
	1986	7,412	0.98	7,250
	1987	7,170	5.52	39,600
	1988	7,100	5.52	39,200
	1989	7,130	2.83	20,200
	1990	7,330	2.61	19,100
	1991	7,440	3.83	28,500
	1992	7,330	3.79	27,800
	1993	8,070	2.01	16,200

Santa Clara	1980	734	1.50	1,100
	1981	610	1.00	610
	1982	577	1.00	577
	1983	700	5.50	3,850
	1984	810	4.00	3,240
	1985	785	5.00	3,925
	1986	740	0.60	444
	1987	735	5.75	4,226
	1988	800	1.90	1,520
	1989	815	3.50	2,853
	1990	900	1.10	990
	1991	920	4.50	4,140
	1992	935	2.50	2,338
	1993	985	1.70	1,675
Solano	1982	98	1.05	103
	1983	117	1.23	144
	1984	119	0.80	95
	1985	125	1.50	188
	1986	119	1.10	131
	1987	119	1.69	201
	1988	76	0.70	53
	1989	76	0.70	53
	1990	76	0.95	72
	1991	78	0.35	27
	1992	78	1.94	151
	1993	78	0.82	64
Stanislaus	1980	250	3.10	775
	1981	250	4.56	1,140
	1982	259	2.18	565
	1983	288	2.55	734
	1984	383	4.31	1,650
	1985	482	4.77	2,300
	1986	569	3.83	2,180
	1987	712	6.00	4,272
	1988	737	4.75	3,501
	1989	963	3.86	3,740
	1990	1,290	1.28	1,650
	1991	1,510	2.20	3,320
	1992	1,550	3.56	5,520
	1993	1,600	3.20	5,120
Sutter 1/	1987	22	1.77	39
	1988	22	1.32	29
	1989	25	1.92	48
	1990	33	1.06	35
	1991	64	3.00	192
	1992	79	0.46	36
	1993	62	0.34	21

1/ Data for earlier years are not available.

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