Bramble Fruits: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance for Raspberries and Blackberries

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Executive Summary

Bramble fruits refer to blackberries, raspberries, and hybrids (or genetic combinations) of the two crops that are grown for their sweet, juicy berries. Sometimes referred to simply as brambles or bramble berries because of their thorny canes (stalks), bramble fruits belong to the genus *Rubis* and family *Rosaceae*, the rose family. Although the term "bramble" denotes thorniness, some blackberry cultivars (varieties) have been developed that are free of thorns.

In the U.S., large-scale commercial bramble production is located almost exclusively in states along the Pacific Coast. According to the 1992 Census of Agriculture, California, Oregon, and Washington reported 76 percent of the harvested U.S. raspberry acreage. California and Oregon accounted for 69 percent of the harvested U.S. blackberry acreage in 1992, and were also major producers of boysenberries. Oregon is the main producer of loganberries. The remaining bramble fruit production is scattered in small plantings throughout the United States.

Raspberry and blackberry plants have perennial roots and biennial shoots. The roots continue to grow for the life of the planting, but new above-ground shoots (canes) develop each year from crown buds or buds on the roots. Canes produce vegetative growth the first summer and form flower buds in the fall. These buds bloom the following spring and bear fruit during the summer. After bearing, the canes die, completing their life cycle.

Some red raspberry varieties are distinguished by their ability to initiate flower buds on primocanes during their first summer and produce fruit that fall. Cultivars with this growth habit are known variously as "everbearing," "fall-fruiting," or "primocane-bearing" raspberries, and are being widely used as a means of extending the fresh fruit marketing season.

Except in the western commercial production areas, brambles tend to be grown in small plantings. The U.S. Census of Agriculture reported 4,639 farms with 15,899 harvested acres of raspberries and 2,619 farms with 6,994 harvested acres of blackberries in 1992. For those states other than California, Oregon, and Washington, there were 3,522 farms with raspberries and 2,082 with blackberries, and, on average, they harvested just over one acre each. Many of these farms had less than one acre.

More than 95 percent of the bramble fruit grown in Washington and Oregon is sold for processing. Although the usage breakdown between fresh market and processing is not reported, California brambles are grown mainly for the fresh market. Berries may be diverted to processing when fresh-market prices are low or if the berries are of

low quality. Central California is an important fresh-market strawberry area and shippers use the fresh-market infrastructure developed for strawberries to handle and sell raspberries. Although statistics are not available for other states, the fresh market, especially direct-to-consumer sales, reportedly accounts for the bulk of marketings.

Climate, chiefly temperature, is the most important factor affecting the geographic distribution of commercial bramble production. Summer and winter temperatures can be either too hot or too cold for successful berry production. Raspberries and blackberries need to have an extended period during the winter with temperatures below 45^{o} F before they can resume growth in the spring. Failure to satisfy this requirement results in reduced flower bud growth in the spring and diminished yields.

However, extreme low temperatures may kill raspberry and blackberry canes, basal buds, and even the entire plant. Winter injury reportedly is the most serious production peril for both raspberries and blackberries. In general, red raspberries are more hardy than are the black and purple cultivars.

An additional, frequently-cited cause of yield loss among raspberries is root rot, which occurs when the soil is excessively wet. Excessive rains and excessive heat in combination at harvest-time were cited as conditions that contribute to diseases and quality degradation, especially among raspberries. Brambles are also subject to a number of other perils, such as hail, wind, and various insect and disease pests.

Because of their large commercial acreage, the greatest potential for bramble crop insurance exists in California, Oregon, and Washington. Some growers in Washington have indicated an interest in insurance. The Farm Service Agencies in Clark and Whatcom counties report that they have received requests for raspberry insurance and that growers have asked about the availability of such insurance. In addition, the extension farm advisor for brambles in Monterey and Santa Cruz counties in California indicated that several growers had expressed frustration that they did not have crop insurance available during flooding in the spring of 1995.

Even so, disaster assistance payments in these states have been small relative to their acreage, suggesting that growers incur relatively minor yield losses. Disaster payments for Oregon raspberries, for example, accounted for about 6.5 percent of the U.S. total over the 1988-94 period, while the state had 34 percent of U.S. harvested acreage. Large payments have been received by midwestern and northeastern growers in states that account for a small portion of the U.S. total acreage.

Bramble Fruits: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance for Raspberries and Blackberries

Introduction

Bramble fruits refer to blackberries, raspberries, and hybrids (or genetic combinations) of the two crops that are grown for their sweet, juicy berries. Sometimes referred to simply as brambles or bramble berries because of their thorny canes (stalks), bramble fruits belong to the genus *Rubis* and family *Rosaceae*, the rose family. Although the term "bramble" denotes thorniness, some blackberry cultivars (varieties) have been developed that are free of thorns.

Raspberries and blackberries are composite fruits consisting of numerous tiny individual "drupelets" (one-seeded fruits) attached to a central core or receptacle. The main difference between blackberries and raspberries is in the way the ripened berry separates from its stem. Raspberries loosen from the receptacle, leaving a hard, dry, inedible core attached to the plant. This results in a thimble-shaped fruit with a hollow center. On the other hand, blackberries loosen at the base of the receptacle, and the receptacle becomes an integral part of the fruit. The blackberry receptacle is soft, juicy, and edible.

In the U.S., large-scale commercial bramble production is located almost exclusively in states along the Pacific Coast (Figures 1 and 2). According to the 1992 Census of Agriculture, California, Oregon, and Washington reported 76 percent of the harvested U.S. raspberry acreage (Appendix table 1). California and Oregon accounted for 69 percent of the harvested U.S. blackberry acreage in 1992, and were also major producers of boysenberries (Appendix tables 2 and 3). Oregon is the main producer of loganberries (Appendix table 4). The remaining bramble fruit production is scattered in small plantings throughout the United States.

The U.S. Department of Agriculture reports raspberry production for Oregon and Washington, and blackberry production for California and Oregon. Oregon and Washington raspberries had a combined value of $23 million in 1995, and California and Oregon blackberries had a combined value of $21 million.[1]

[1] The value for blackberries includes boysenberries and loganberries produced in California.

Figure 1. Major raspberry counties in California, Oregon, and Washington

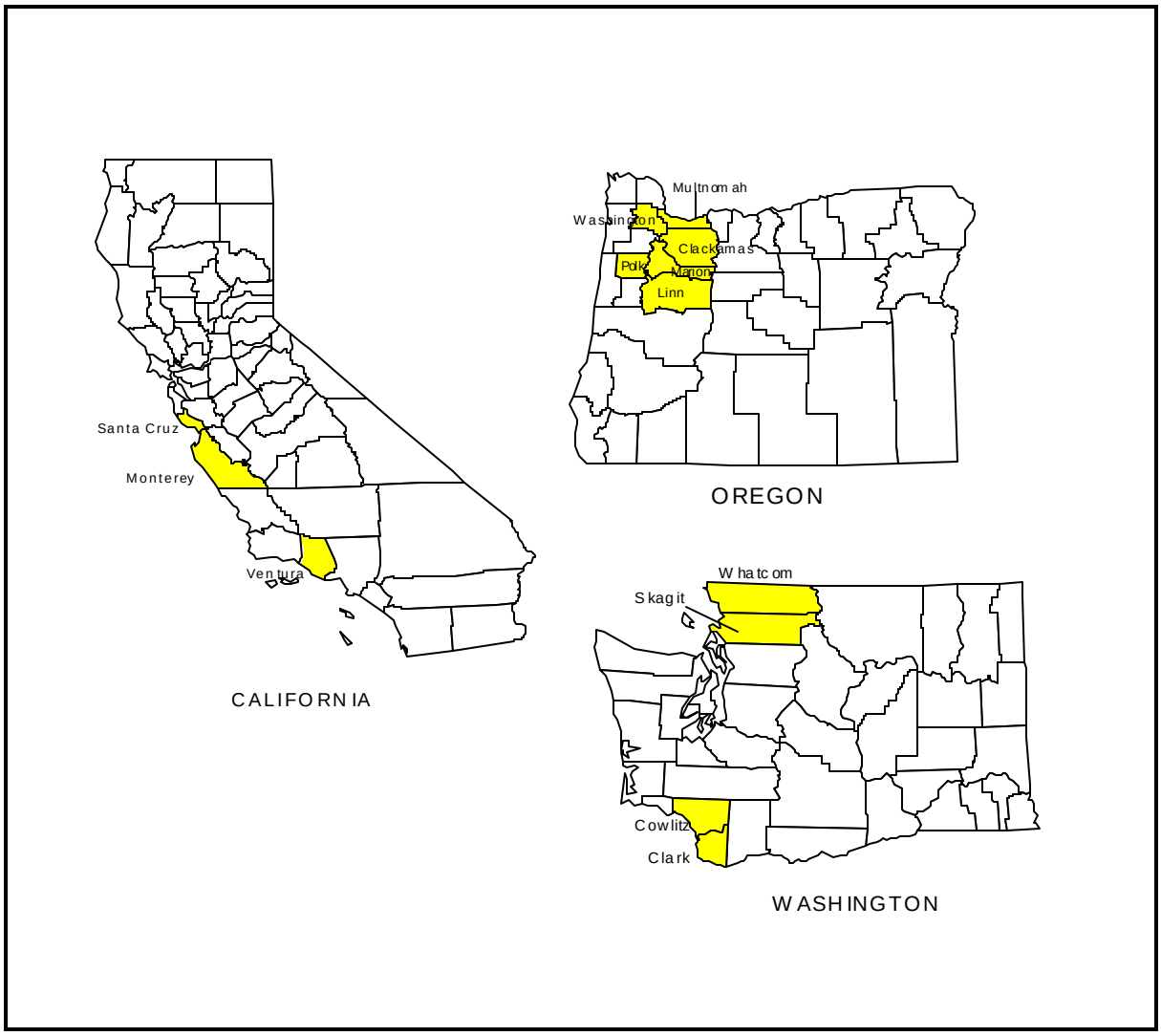
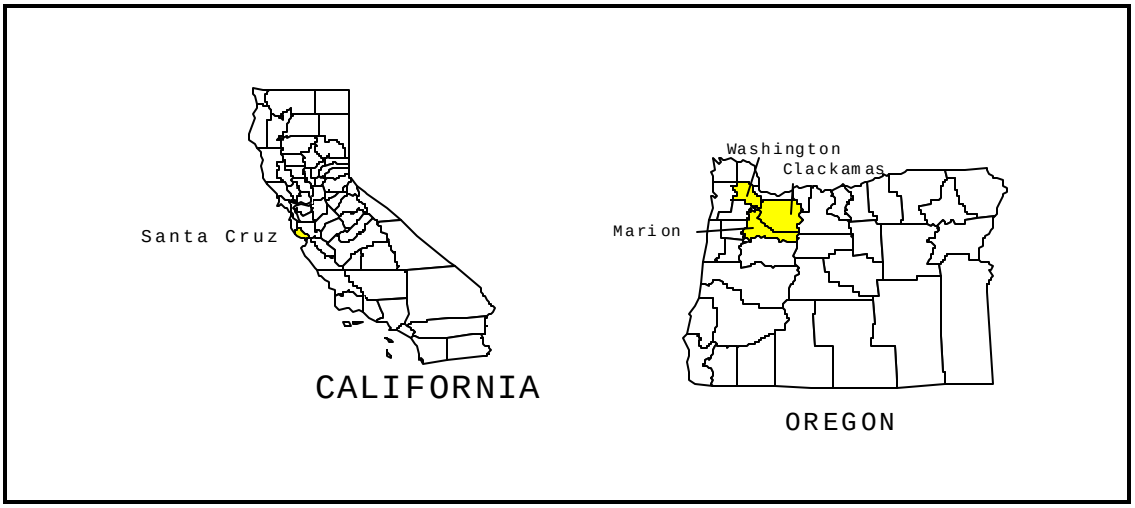


Figure 2. Major blackberry counties in California and Oregon



This report examines those aspects of the U.S. bramble fruit industry that relate to the demand for crop insurance and the feasibility of developing an insurance policy for bramble crops.

The Bramble Plant

Raspberry and blackberry plants have perennial roots and biennial shoots. The roots continue to grow for the life of the planting, but new above-ground shoots (canes) develop each year from crown buds or buds on the roots. Canes produce vegetative growth the first summer and form flower buds in the fall. These buds bloom the following spring and bear fruit during the summer. After bearing, the canes die, completing their life cycle. First-year shoots are referred to as primocanes, while second-year shoots are called floricanes. Both exist on the plant at the same time, but the floricanes are usually removed shortly after harvest to promote vigorous growth among the primocanes.

Nearly all bramble cultivars are self-fruitful, meaning that a stamen's pollen can fertilize the pistil of the same flower or of another flower of the same species and produce an individual drupelet. Generally, eighty or more pistils per flower need to be pollinated and form drupelets for a berry to be commercially acceptable (Crandall).

Flying insects, primarily honeybees, account for over 90 percent of the pollen transfer (Crandall). Commercial growers move hives of honeybees into the field during blossoming to assure adequate pollination. One or two hives per acre grouped into units of five or ten per location are generally recommended.

Following pollination, raspberries require 30-35 days to reach maturity, while blackberries require 35-45 days. The bulk of a berry's enlargement and weight gain occur during the later stages of the maturation process.

Types of Brambles

Several types of brambles are produced in the U.S., including red raspberries; black raspberries; yellow and purple raspberries; and blackberries.

Red Raspberries

Red raspberries are native to Asia Minor, where they grew wild in a region near Mount Ida. Currently, large commercial acreages of red raspberries are grown in Great Britain, Europe, Canada, the United States, Chile, New Zealand, and Australia.

Some red raspberry varieties are distinguished by their ability to initiate flower buds on primocanes during their first summer and produce fruit that fall. Cultivars with this growth habit are known variously as “everbearing,” “fall-fruiting,” or “primocane-bearing” raspberries, and are being widely used as a means of extending the fresh fruit marketing season.[2] In addition to extending the raspberry season, these primocane-bearing berries can be grown successfully in regions where low winter temperatures would severely damage or kill raspberry canes. In these areas, cold damage is avoided by cutting off the canes at ground level in the fall. The primocanes that grow from root buds the following spring bear fruit during the fall. Although this practice sacrifices the summer crop, it produces an abundant fall harvest which continues until frost.

Red raspberries are the most widely-grown bramble fruit in the United States. Although the bulk of U.S. commercial production is located in Oregon and Washington, small acreages are reported in every state except Hawaii (Census of Agriculture, 1992).

The principal cultivars produced in the Pacific Northwest are ‘Willamette’ and ‘Meeker.’[3] They are well-suited for commercial production because they can be machine-harvested. In addition, they produce high yields of large, firm berries that are especially well-adapted to the processing market. New varieties being adopted in the Pacific Northwest are ‘Chilliwack’ and ‘Tulameen,’ which are suitable for both the processing and fresh markets.

‘Heritage’ and ‘Willamette’ are the principal varieties grown in California, where they are used primarily for the fresh fruit market. ‘Latham’ is the long-time standard cultivar for the midwestern and northeastern United States, primarily because of its winter hardiness and relatively wide adaption. ‘Boyne,’ a new, hardy cultivar, is replacing ‘Latham’ in some colder areas.

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[2] Although referred to as "fall-bearing," the primocanes on such varieties begin yielding berries in late summer and continue bearing into the fall, until cold weather forces the plant into dormancy.

[3] Many raspberry and blackberry varieties are grown in the United States. Some are long-time standards and others are promising new cultivars that are being grown on a trial basis. Appendix A provides a brief description of some of the varieties currently produced.

Black Raspberries

Black raspberries are native to North America. They are not as winter hardy as red raspberries and they are more susceptible to diseases. In addition, black raspberries are less productive than are red raspberries. Nevertheless, black raspberries impart a unique flavor to many products, and substantial quantities are produced commercially in western Oregon.

The major black raspberry varieties grown for processing in Oregon are 'Munger' and 'Bristol.' 'Munger' is by far the most widely planted. Because they are less winter-hardy than red raspberries, few black raspberries are grown in the midwestern and northeastern United States. 'Cumberland' and 'Bristol' are the two most commonly grown cultivars in these areas.

Purple and Yellow Raspberries

Purple raspberries are hybrids of black and red cultivars. They are intermediate between red and black raspberries in growth habit, have large fruit, and are juicer and more productive than are black raspberries. Purple raspberry production is limited almost entirely to small plantings in the Midwest and Northeast.

Several yellow raspberry varieties are grown in small plantings throughout the United States. Except for color, yellow raspberries resemble red raspberries, having similar appearance and flavor. Yellow raspberries are primarily grown for specialty markets.

Blackberries

Blackberries are classified according to their growth habit into erect, semi-erect, or trailing types, and they may or may not have thorns. The erect types have arched, self-supporting canes, while the trailing types have recumbent canes that naturally trail along the ground. In commercial plantings, trailing blackberry canes are tied to poles or trellises to keep them up off the ground. The fruit clusters are more open on the trailing types than on the erect types.

The semi-erect types produce thin, trailing canes the first year after planting. In subsequent years, semi-erect plants produce sturdy, upright canes that arch back to the ground if not supported by a trellis.

The erect species produce new plants from buds on the roots. The semi-erect and trailing types, however, have few or no vegetative buds on the roots. Instead, the tips of their primocanes form roots where they touch the soil and new plants grow from these roots.

The major commercial blackberry varieties in the Pacific Northwest are ‘Marion’ and ‘Thornless Evergreen.’ Limited quantities of ‘Logan,’ ‘Boysen,’ and ‘Olallie’ are also grown in this area. ‘Boysen’ and Olallie’ are the principal varieties grown for processing in the San Joaquin Valley of California, while ‘Shawnee’ is the most widely grown cultivar in the southern part of the United States. Blackberry production in the Midwest and Northeast consists of many small acreages located close to population centers where the berries can be sold in local fresh markets. Numerous varieties are grown in these areas, but none are of commercial significance because of their small associated acreage.

The Bramble Fruit Industry

Location

Brambles are grown throughout the United States. The Census of Agriculture reported 49 states with farms harvesting raspberries in 1992 (only Hawaii had no raspberries) and 40 states with farms harvesting blackberries. Two-thirds of the harvested raspberry acreage was located in Oregon and Washington and an additional 9 percent was located in coastal California in 1992 (Appendix table 1). Michigan, New York, and Ohio each accounted for 2 percent or more of U.S. harvested acreage.

The Pacific Coast states also accounted for nearly 70 percent of the blackberry acreage, with 64 percent in Oregon and 6 percent in California (Appendix table 2). Texas reported an additional 5 percent.

Loganberries and boysenberries are mainly produced in California, Oregon, and Washington. These three states had 345 of the 347 farms with boysenberries in 1992 and all of the farms with loganberries (Appendix tables 3 and 4). Loganberries and boysenberries are types of blackberry and share the same cultural requirements and production perils. They have different taste characteristics than other blackberries, however, and are, therefore, not close substitutes for one another in most uses. Loganberry and boysenberry statistics are usually reported separately from other blackberries.

Farms with Brambles

Except in the western commercial production areas, brambles tend to be grown in small plantings. The U.S. Census of Agriculture reported 4,639 farms with 15,899 harvested acres of raspberries and 2,619 farms with 6,994 harvested acres of blackberries in 1992. For those states other than California, Oregon, and Washington, there were 3,522 farms with raspberries and 2,082 with blackberries, and, on

average, they harvested just over one acre each. Many of these farms had less than one acre.

Sales data suggest that the majority of farms producing brambles are small-scale operations often operated by part-time farmers. Seventy-three percent of the raspberry and 77 percent of the blackberry farms had total farm sales of $25,000 or less in 1987 (Appendix tables 5 and 6). Even among the commercial states, half or more of the farms producing brambles had sales of less than $25,000. A similar situation appears for boysenberries and loganberries (Appendix tables 7 and 8). Many small operators may be persons with off-farm earnings or retirees who grow brambles for supplemental income.

The Bramble Fruit Market

Supply

USDA reported 71 million pounds of red raspberry production in Washington and Oregon in 1995, 98 percent of which was used for processing (Table 1). USDA also reported 15 million pounds of raspberries produced in California (Table 2). The bulk of California's output is grown for the fresh market. Other states produce an undetermined amount of raspberries, primarily for the fresh market. Oregon is the principal supplier of black raspberries, producing 2.6 million pounds in 1995 (Table 3).

In addition to domestic production, the U.S. imports both fresh and frozen raspberries. Fresh berries from Canada account for the largest volume. Chile, Colombia, Mexico, and Guatemala ship a substantial amount of fresh raspberries into the United States during the winter and spring (Table 4). U.S. frozen raspberry imports arrive mostly from Canada and Chile.

Red raspberry production in Oregon and Washington has risen sharply in recent years. Combined production rose from 29 million pounds in 1985 to 71 million pounds in 1995. The increased output may reflect producers' response to high prices during the past 5 years. The high prices occurring since 1990 are in part due to civil unrest in the former Yugoslavia, which disrupted the world supply of frozen raspberries. Yugoslavia is a major world producer of red raspberries.

Oregon is the principal supplier of blackberries, producing 37.5 million pounds in 1995 (Table 5). Most of these are used for

Table 1--Red raspberries: Commercial acreage, yield per acre, production, and season-average grower price, Oregon and Washington, 1975-95

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
Oregon									
1975	2,100	4,860	10,200	700	9,500	46.6	22.0	23.7	2,417
1976	2,000	4,500	9,000	800	8,200	42.0	30.8	31.8	2,862
1977	1,900	5,530	10,500	700	9,800	60.0	50.4	51.0	5,355
1978	1,900	5,050	9,600	400	9,200	71.0	74.8	74.6	7,162
1979	2,000	5,000	10,000	700	9,300	60.4	68.8	68.2	6,821
1980	2,100	5,050	10,600	600	10,000	50.7	27.4	28.7	3,044
1981	2,000	6,000	12,000	600	11,400	54.2	51.0	51.2	6,139
1982	2,500	5,400	13,500	1,000	12,500	78.0	70.0	70.6	9,530
1983	2,500	5,600	14,000	1,000	13,000	65.0	35.9	38.0	5,320
1984	2,700	5,480	14,800	800	14,000	65.0	53.0	53.6	7,940
1985	2,800	4,460	12,500	500	12,000	80.0	52.5	53.6	6,700
1986	3,100	4,000	12,400	300	12,100	82.0	76.5	76.6	9,503
1987	3,500	6,140	21,500	600	20,900	76.0	50.0	50.7	10,906
1988	3,700	5,140	19,000	650	18,350	99.0	53.5	55.1	10,461
1989	4,000	6,250	25,000	600	24,400	94.0	55.5	56.4	14,106
1990	4,200	5,120	21,500	500	21,000	88.0	31.7	33.0	7,097
1991	4,000	4,130	16,500	300	16,200	108.0	53.0	54.0	8,910
1992	4,000	5,500	22,000	400	21,600	108.0	53.0	54.0	11,880
1993	3,700	4,460	16,500	500	16,000	115.0	69.5	70.9	11,695
1994	3,800	5,790	22,000	1,000	21,000	157.0	86.5	89.7	19,735
1995	4,000	4,630	18,500	700	17,800	154.0	74.0	77.0	14,250
Washington									
1975	3,000	5,500	16,500	1,100	15,400	54.2	22.8	24.9	4,109
1976	2,900	5,080	14,732	1,312	13,420	43.0	28.3	29.6	4,361
1977	2,800	5,230	14,644	1,615	13,029	48.8	44.1	44.6	6,531
1978	2,600	5,100	13,260	1,017	12,243	66.7	70.7	70.4	9,335
1979	2,600	4,900	12,740	1,790	10,950	75.5	68.5	69.5	8,852
1980	2,800	4,500	12,600	2,240	10,360	69.6	30.3	37.3	4,698
1981	3,000	4,750	14,250	2,350	11,900	68.1	48.8	52.0	7,408
1982	3,100	5,700	17,670	1,800	15,870	78.8	66.0	67.3	11,892
1983	3,000	5,800	17,400	1,740	15,660	83.4	38.5	43.0	7,482
1984	3,000	5,450	16,350	1,150	15,200	78.5	47.0	49.2	8,047
1985	3,200	5,250	16,800	1,000	15,800	75.9	54.9	56.1	9,433
1986	3,300	4,200	13,860	1,040	12,820	86.0	75.0	75.8	10,509
1987	3,600	6,400	23,040	1,300	21,740	93.6	50.1	52.6	12,109
1988	4,000	6,300	25,200	1,200	24,000	83.5	52.0	53.5	13,482
1989	4,200	6,900	28,980	1,100	27,880	85.0	55.0	56.1	16,269
1990	5,400	5,200	28,080	1,280	26,800	90.0	35.0	37.5	10,532
1991	5,300	6,100	32,330	1,030	31,300	108.0	49.0	50.9	16,449
1992	5,300	7,800	41,340	1,440	39,900	115.0	51.0	53.2	22,005
1993	5,200	8,200	42,640	1,640	41,000	140.0	63.0	66.0	28,126
1994	5,700	8,200	46,740	1,840	44,900	166.0	81.0	84.3	39,423
1995	5,900	8,900	52,510	1,010	51,500	118.0	66.0	67.0	35,182

Sources: Oregon Department of Agriculture, Oregon Agricultural Statistics Service; Washington Department of Agriculture, Washington Agricultural Statistics Service; and U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 2--All raspberries: Commercial acreage, yield per acre, production, season-average grower price, and value, California, 1990 to 1995

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
1990	1,700	10,400	17,700	na	na	na	na	1.650	29,228
1991	na	na	na	na	na	na	na	na	na
1992	1,600	16,500	26,400	na	na	na	na	1.830	48,276
1993	1,850	14,200	26,300	na	na	na	na	1.480	39,000
1994	1,900	11,100	21,000	na	na	na	na	1.430	30,000
1995	1,900	8,050	15,300	na	na	na	na	1.520	23,325

na = not available.

Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 3--Black raspberries: Commercial acreage, yield per acre, production, and season-average grower price, Oregon and Washington, 1975 to date

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
Oregon									
1975	1,300	1,850	2,400	150	2,250	61.7	50.0	50.7	1,217
1976	1,200	1,500	1,800	125	1,675	41.8	50.0	49.4	889
1977	1,200	1,920	2,300	100	2,200	64.0	61.9	62.0	1,426
1978	1,200	1,580	1,900	40	1,860	75.0	75.0	75.0	1,425
1979	1,300	1,850	2,400	30	2,370	90.0	93.0	93.0	2,231
1980	1,700	1,820	3,100	30	3,070	58.8	45.4	45.5	1,411
1981	1,600	2,010	3,220	20	3,200	50.0	24.1	24.3	781
1982	1,500	1,850	2,770	10	2,470	50.0	27.5	27.6	684
1983	1,350	2,150	2,900	10	2,890	60.0	53.0	53.0	1,538
1984	1,300	1,540	2,000	20	1,980	110.0	95.0	95.2	1,903
1985	1,350	1,560	2,100	20	2,080	157.0	136.2	136.2	2,860
1986	1,550	1,870	2,900	0	2,900	0.0	180.0	180.0	5,200
1987	1,750	2,490	4,350	10	4,340	90.0	52.0	52.1	2,266
1988	1,500	2,500	3,750	20	3,730	88.0	34.5	34.8	1,305
1989	1,400	1,930	2,700	50	2,650	120.0	38.0	39.5	1,067
1990	1,400	1,820	2,550	30	2,520	122.0	120.0	120.0	3,061
1991	1,100	1,450	1,600	10	1,590	200.0	203.0	203.0	3,248
1992	1,100	2,180	2,400	30	2,370	153.0	148.0	148.0	3,554
1993	1,150	2,430	2,800	20	2,780	188.0	161.0	161.0	4,514
1994	1,150	3,300	3,800	20	3,780	150.0	100.0	100.0	3,810
1995	1,200	2,130	2,550	10	2,540	159.0	60.4	61.0	1,550
Washington 1/									
1975	140	1,210	170	3	167	50.0	50.0	50.0	85
1976	110	1,110	122	4	118	50.0	50.0	50.0	61
1977	110	1,730	190	4	186	50.0	65.0	64.7	123
1978	130	1,360	177	3	174	75.0	75.0	75.0	133
1979	130	2,200	286	2	284	86.7	86.7	86.7	248
1980	120	1,460	175	2	173	41.0	41.0	41.0	72
1981	120	670	80	4	76	47.5	25.0	26.1	21
1982	110	1,230	135	4	131	29.0	29.0	29.6	40
1983	110	1,000	110	10	100	65.0	50.0	51.4	57
1984	100	850	85	15	70	59.0	55.0	55.3	47
1985	100	950	95	25	70	135.0	140.0	138.9	132
1986	100	700	70	14	56	170.0	165.0	165.7	116
1987	100	1,100	110	23	87	55.0	49.2	50.4	55
1988	80	1,300	104	20	84	100.0	41.0	51.9	54

1/ Not reported after 1988.
Sources: Oregon Department of Agriculture, Oregon Agricultural Statistics Service; Washington Department of Agriculture, Washington Agricultural Statistics Service; and U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 4--Raspberries and Blackberries: U.S. imports, 1993-1995

Item	Principal sources	1993	1994	1995
		----------Metric tons----------		
Raspberries:				
Fresh	Canada, Colombia, Chile Guatemala	5,895	7,429	8,026
Frozen	Canada, Chile	2,337	2,780	3,312
Blackberries:				
Fresh	Guatemala	204	346	649
Frozen	Chile, Mexico	40	105	416
Loganberries:				
Fresh	Guatemala	222	153	104
Frozen	Chile	304	233	659

Source: U.S. Department of Commerce, Bureau of the Census.

Table 5--Blackberries: Commercial acreage, yield per acre, production, and season-average grower price, Oregon and Washington, 1975 to date

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
Oregon									
1975	3,000	6,830	20,500	300	20,200	21.0	14.4	14.5	2,973
1976	2,600	8,190	21,300	400	20,900	28.1	29.0	29.0	6,177
1977	2,600	7,000	18,200	400	17,800	56.5	45.3	45.5	8,281
1978	3,000	6,700	20,100	400	19,700	55.5	50.7	50.8	10,211
1979	2,500	5,600	14,000	550	13,450	66.2	58.0	58.3	8,165
1980	3,400	8,470	28,800	400	28,400	41.2	20.1	20.4	5,873
1981	3,000	6,580	18,000	450	17,550	30.5	17.2	17.5	3,150
1982	3,000	6,830	18,600	900	17,700	44.2	23.2	24.2	4,504
1983	3,000	7,000	20,250	200	20,050	49.5	29.1	29.3	5,943
1984	3,100	6,190	19,200	400	18,800	49.8	49.8	49.8	9,558
1985	3,400	7,060	24,000	200	23,800	60.5	57.8	57.8	13,873
1986	3,600	6,390	23,000	200	22,800	67.0	60.9	60.9	14,018
1987	4,900	7,670	37,600	610	36,990	60.7	27.7	28.3	10,629
1988	4,400	7,720	33,950	1,100	32,850	58.1	30.0	30.9	10,498
1989	4,200	5,520	23,200	700	22,500	57.7	37.1	37.7	8,748
1990	4,150	7,730	32,100	900	31,200	92.6	37.4	39.0	12,512
1991	3,050	5,510	16,800	700	16,100	146.0	83.2	85.8	14,413
1992	4,700	9,110	42,800	1,100	41,700	88.7	43.9	45.1	19,284
1993	4,700	6,470	30,400	1,200	29,200	86.5	29.1	31.4	9,539
1994	5,040	7,480	37,700	1,200	36,500	95.0	35.8	37.7	14,207
1995	4,900	7,650	37,500	850	36,650	110.0	54.3	55.6	20,836
Washington 1/									
1975	210	7,330	1,540	17	1,523	25.7	13.4	13.5	208
1976	210	6,600	1,386	20	1,366	35.6	28.4	28.5	395
1977	210	5,900	1,239	42	1,197	53.3	40.0	40.5	502
1978	200	5,300	1,060	45	1,015	48.9	52.5	49.1	520
1979	200	2,540	508	21	487	50.0	55.4	55.2	280
1980	240	3,500	840	37	803	55.0	14.0	15.8	133
1981	220	3,750	825	250	575	55.0	8.3	22.5	186
1982	160	3,800	608	308	300	44.1	11.0	27.8	169
1983	160	4,250	680	190	490	54.8	20.4	30.0	204
1984	160	5,000	800	200	600	58.0	40.0	44.5	356
1985	150	4,700	705	315	390	62.0	46.0	53.2	375
1986	150	3,800	570	170	400	75.0	41.0	51.1	292
1987	150	5,400	810	260	550	62.0	29.8	40.1	325
1988	150	5,500	825	325	500	74.5	32.0	48.7	402
1989	130	5,500	715	300	415	75.0	25.0	46.0	329

1/ Not reported after 1989.

Sources: Oregon Department of Agriculture, Oregon Agricultural and Fisheries Statistics; Washington Department of Agriculture, Washington Agricultural Statistics Service; and U.S. Department of Agriculture, National Agricultural Statistics Service.

processing. Other states, especially in the middle and southern latitudes of the U.S., produce an unknown volume of blackberries, most of which are sold in local fresh markets. In addition to domestic output, the U.S. imports a small amount of blackberries, mainly fresh product from Guatemala. Chile and Mexico are the principal sources of frozen blackberry imports. Oregon is also the principal supplier of boysenberries and loganberries (Tables 6 and 7).

Demand

Information on raspberry and blackberry consumption in the United States is sketchy because production is only reported for three states--California, Oregon, and Washington. The most complete data relate to frozen raspberries and blackberries, for which the Economic Research Service (ERS) estimates total and per-capita consumption. These estimates indicate that per capita combined use of frozen raspberries and blackberries rose from about 0.17 pounds per person in 1975 to about 0.28 pounds in 1995 (Table 8).
Although these data suggest rising consumption, they may overstate any upward trend. There is a great deal of year-to-year variation in use, and consumption during some intervening years fell below the 1975 level, while in other years, use exceeded that which occurred in 1995.

Prices

Fresh-market berries almost always sell for a premium over those sold for processing. Data for Washington and Oregon suggest that fresh-market raspberry prices average about double the prices for processing berries. One reason is that harvesting and marketing costs are higher for fresh-market berries, which must be hand picked and marketed in retail-sized containers. In contrast, processing berries are usually machine harvested and handled in reusable containers. Harvesting and marketing expenses for fresh-market berries may be as much as ten times the cost for berries used for processing.

Raspberry prices vary widely from year to year, as illustrated in Figure 3 for red raspberries in Washington and Oregon. Since processing berries dominate in these two states, the prices are weighted heavily toward processing.

Between 1990 and 1994, rising prices and increasing production suggest that the demand for U.S. red raspberries was increasing. Although prices peaked in 1994, they still remained at a relatively high level in 1995 when compared with prices in 1990 and prior years. Average prices may weaken during the last half

Table 6--Boysenberries: Commercial acreage, yield per acre, production, and season-average grower price, California and Oregon, 1975 to date

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
Oregon									
1975	950	3,790	3,600	160	3,440	27.3	18.0	18.4	662
1976	600	3,750	2,250	275	1,975	29.3	28.3	28.4	639
1977	700	4,500	3,150	150	3,000	65.0	65.0	65.0	2,048
1978	750	2,670	2,000	100	1,900	80.0	81.5	81.4	1,628
1979	800	2,940	2,350	100	2,250	80.0	79.7	79.7	1,873
1980	1,000	3,500	3,500	100	3,400	45.8	30.6	31.0	1,086
1981	950	3,000	2,850	100	2,750	43.4	28.4	28.9	824
1982	1,000	4,200	4,200	200	4,000	42.0	32.3	32.8	1,376
1983	950	3,740	3,550	200	3,350	45.0	34.0	34.6	1,229
1984	900	3,700	3,330	200	3,130	71.0	71.0	71.0	2,364
1985	900	4,000	3,600	100	3,500	82.0	79.0	79.1	2,847
1986	850	4,350	3,700	50	3,650	77.0	80.0	80.0	2,959
1987	1,000	5,300	5,300	50	5,250	67.0	52.0	52.2	2,764
1988	950	5,680	5,400	100	5,300	43.0	73.0	42.4	2,320
1989	900	3,440	3,100	100	3,000	51.0	72.0	50.3	1,581
1990	1,000	4,500	4,500	100	4,400	81.0	55.0	55.6	2,501
1991	900	4,670	4,200	100	4,100	97.5	99.8	99.8	4,190
1992	1,000	6,150	6,150	150	6,000	125.0	64.0	65.5	4,028
1993	1,000	4,550	4,550	150	4,400	115.0	74.0	75.4	3,429
1994	1,200	5,080	6,100	100	6,000	103.0	62.5	63.2	3,853
1995	1,200	3,980	4,780	80	4,700	134.0	77.5	78.5	3,750
California									
1990	450	8,000	3,600	N.A.	N.A.	N.A.	N.A.	88.0	3,168
1991	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1992	200	8,500	1,700	N.A.	N.A.	N.A.	N.A.	91.1	1,548
1993	250	9,000	2,250	N.A.	N.A.	N.A.	N.A.	88.0	1,980
1994	250	8,000	2,000	N.A.	N.A.	N.A.	N.A.	75.5	1,510
1995	270	6,670	1,800	N.A.	N.A.	N.A.	N.A.	95.0	1,710

N.A. = Not available.

Sources: Oregon Department of Agriculture, Oregon Agricultural Statistics Service; U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 7--Loganberries: Commercial acreage, yield per acre, production, and season-average grower price, Oregon, 1975 to date

State and year	Acreage harvested	Yield/ acre	Utilized production	Utilization		Grower price			Value of utilized production
				Fresh	Processed	Fresh	Processed	All	
	Acres	Pounds	---1,000 pounds---			---Cents/pound---			$1,000
Oregon									
1975	440	6,360	2,800	50	2,750	26.6	20.0	20.1	563
1976	470	5,320	2,500	50	2,450	27.0	20.4	20.5	513
1977	500	7,200	3,600	60	3,540	45.0	41.9	42.0	1,512
1978	470	5,320	2,500	50	2,450	45.0	41.3	41.4	1,035
1979	400	2,900	1,160	30	1,130	60.0	60.9	60.9	706
1980	420	5,360	2,250	30	2,220	44.6	24.5	24.8	557
1981	450	3,420	1,540	40	1,500	23.0	18.8	18.9	291
1982	500	4,200	2,100	50	2,050	47.5	35.0	35.3	742
1983	450	5,330	2,400	80	2,220	35.0	25.7	26.0	598
1984	420	3,330	1,400	100	1,300	43.0	40.0	40.2	563
1985	330	3,790	1,250	50	1,200	51.0	49.5	49.6	620
1986	230	5,650	1,300	30	1,270	86.0	75.0	75.3	979
1987	240	5,330	1,280	30	1,250	61.0	35.0	35.6	456
1988	240	5,670	1,360	10	1,350	35.3	67.0	35.0	480
1989	200	3,250	650	25	625	45.2	64.0	44.5	294
1990	160	6,250	1,000	10	990	77.0	38.0	38.4	384
1991	100	1,800	180	10	170	105.0	80.0	81.7	147
1992	110	6,000	660	10	650	101.0	48.5	49.2	325
1993	90	5,000	450	90	360	156.0	60.0	79.1	356
1994	90	4,440	400	70	330	100.0	78.5	82.3	329
1995	80	3,880	310	70	240	142.0	68.0	84.5	262

Sources: Oregon Department of Agriculture, Oregon Agricultural Statistics Service; U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 8--Frozen blackberries and raspberries: U.S. supply and utilization, 1992-95

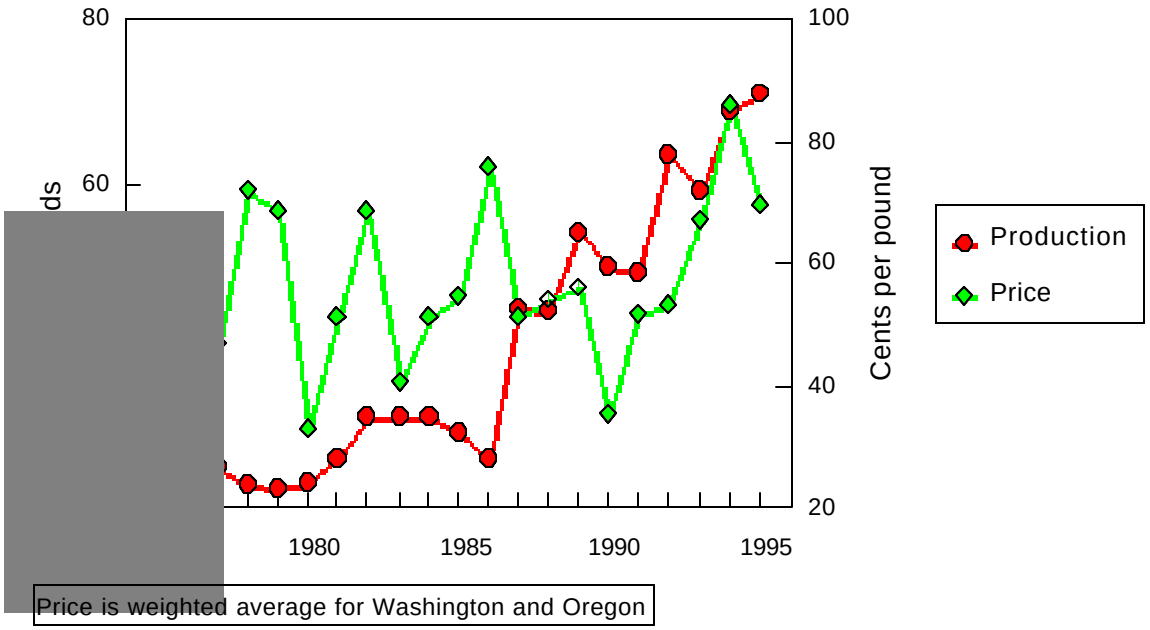
Year	Pack 1/	Imports	Beginning stocks	Total supply	Ending stocks	Exports	Consumption	
							Total	Per capita
	----------Million pounds----------							Pounds
Raspberries								
1992	32.145	4.546	29.100	65.791	35.697	--	30.094	0.1178
1993	25.479	5.153	35.697	66.329	34.117	--	32.212	0.1247
1994	29.900	6.131	34.117	70.148	39.866	--	30.282	0.1162
1995	40.109	7.304	39.866	87.279	45.030	--	42.249	0.1606
Blackberries								
1992	31.498	--	8.600	40.098	22.529	--	17.569	0.0688
1993	23.118	--	22.529	45.647	17.001	--	28.646	0.1109
1994	24.226	--	17.001	41.227	21.188	--	20.039	0.0769
1995	26.823	--	21.188	48.011	16.067	--	31.944	0.1214
Other berries 2/								
1992	8.551	2.814	1.827	13.192	3.427	3.899	5.866	0.0230
1993	4.526	1.015	3.427	8.968	3.673	2.695	2.600	0.0101
1994	5.164	1.095	3.673	9.932	3.046	3.470	3.416	0.0131
1995	3.459	2.989	3.046	9.494	2.120	3.670	3.704	0.0141

1/ Total United States frozen pack from the American Frozen Food Institute.
2/ Other berries pack is the sum of pack for boysenberries and loganberries. Does not include U.S. pack of loganberries for 1995.

Source: U.S. Department of Agriculture, Economic Research Service.

Figure 3. Red raspberry price and production

Washington and Oregon, 1975-95



Price is weighted average for Washington and Oregon

of the 1990's as production rises due to increases in planted acreage.

Environmental Requirements and Production Practices

Climate

Climate, chiefly temperature, is the most important factor affecting the geographic distribution of commercial raspberry and blackberry production. Summer and winter temperatures can be either too hot or too cold for successful berry production in many areas of the United States.

Raspberries and blackberries both need to have an extended period during the winter with temperatures below 45° F before they can resume normal growth in the spring. The length of this period is known as the "chilling requirement," and varies with the cultivar and species. The 'Latham' red raspberry, for example, has a long chilling requirement, at about 1,400 hours. In contrast, the newly-developed cultivar 'Anita' requires only 250 chilling hours. Failure to satisfy the chilling requirement results in reduced flower bud growth in the spring and diminished yields.

However, extreme low temperatures may kill raspberry and blackberry canes, basal buds, and even the entire plant. In general, red raspberries are more hardy (tolerant of low winter temperatures) than are the black and purple cultivars. Erect blackberries are more hardy than the trailing types, and thorny cultivars are more hardy than the thornless types. Practical low temperature limits for red raspberries are about -20° F; for purple raspberries, -10° F; for black raspberries, -5° F; and for blackberries, 0° F. Injury may occur at higher temperatures if the canes are exposed to desiccating winds or if the plants have been weakened by disease or other causes.

Another type of cold damage occurs due to freezing temperatures at blossom time. Temperatures that are a few degrees below freezing at or near the time of full bloom damage the blossoms and prevent fruit set. This type of injury is common in some areas among raspberries and early-flowering blackberries.

Excessively warm summer temperatures also limit production. Red raspberries are especially susceptible to losses due to hot, dry summers. A combination of heat, bright sun, and low humidity can reduce fruit size and cause sunburn damage on exposed fruit. Blackberries are better adapted to extreme heat than raspberries, although they are not completely immune to injury.

Soil

Brambles produce the highest yields on fertile, deep, well-drained sandy loam or loam soils. They can also be produced satisfactorily on sandy soils, but require frequent irrigation and special efforts to build up and maintain organic matter. Poor bramble sites include those having heavy, poorly-drained clay soils, those located over high water tables, or those that are subject to flooding. Raspberry roots, in particular, lose their ability to resist the invasion of root rot diseases in saturated soils and may suffocate from the lack of oxygen during prolonged submersion. Blackberries are more tolerant of poor soil aeration than are raspberries, but they, too, produce the highest yields on well-drained soils.

Raspberries and blackberries should not be planted in fields that have been used for strawberries, peppers, tomatoes, potatoes, or eggplant during the past four or five years, as these plants may host *Verticillium* wilt and the soil may still harbor the disease. Raspberries, in particular, are very susceptible to *Verticillium* wilt. Soils with a history of *Phytophthora* root rot or crown gall also should be avoided as planting sites.

Sites on rolling or flat land are better for bramble production than valley bottoms. Cold air, being heavier than warm air, settles to low areas where localized low spring temperatures are likely to kill the blossoms. Southern slopes may make poor bramble sites because they warm up first in the spring, which promotes early fruit bud development. Developed buds and blossoms are more vulnerable to frost damage than those that are less developed.

Irrigation and Water Supplies

Although summer rainfalls frequently provide adequate moisture for good growth and high yields in temperate regions, occasional extended dry spells can reduce yields substantially. Raspberries and blackberries obtain nearly all of their moisture from the top two feet of the soil profile because this is the region of greatest root development. A moisture deficiency in this root zone from early spring until harvest retards lateral root development and diminishes fruit size.

Primocanes also develop most rapidly between early spring and harvest, and moisture deficiency over this period limits the number of new canes that develop. Primocanes that develop under drought stress have smaller diameters and are less productive than those that develop when moisture is adequate.

Irrigation enables growers to supplement rainfall as needed and reduces the chances of yield loss due to drought. Approximately two-thirds of the U.S. raspberry acreage and three-quarters of the blackberry acreage were irrigated in 1992 (Appendix tables 1 and 2).

The bulk of the irrigated bramble acreage is equipped with overhead sprinklers (Crandall). In addition to providing supplemental water

during dry spells, overhead sprinklers can be used to keep blossoms wet and stave off freeze damage at low temperatures. Wetting the blossoms keeps the temperature above the critical 29° F to 30° F range where freeze damage is likely to occur.

Planting

Brambles may be planted either in the early spring or late fall. Spring planting (in March or April) is recommended in colder climates to avoid winterkill among the young plants. A light mulch in the rows of fall-planted brambles will reduce plant losses due to heaving, which is caused by the freezing and thawing of the soil over the winter. In milder climates, brambles can be successfully planted in late October or early November, when the plants have entered dormancy but before the soil freezes.

Because the principal control for bramble diseases and viruses is to avoid introducing infected plants into new plantings, new plants should be certified disease-free. Most major nurseries reportedly follow propagation methods that insure producers receive disease- and virus-free plants (Crandall).

Row Spacing

Rows are typically spaced 6-12 feet apart, depending on the size of the equipment used by the grower. Typically, rows are 2-3 feet wider than the outside width of the widest machinery. Blackberries are usually spaced wider than raspberries because they tend to be more vigorous and require more space.

A north-to-south row direction helps prevent sunburned fruit on the south sides of rows during hot summer days and promotes uniform fruit production on both sides of the rows. As a practical matter, however, rows are usually laid out to accommodate field shape.

Training and Pruning Systems

The canes of vigorous brambles grow too long to stand upright without support. The growth of black and purple raspberries and erect blackberries is controlled by “tip pruning” (cutting the tops back) during the summer. Tip pruning the canes to 20-24 inches promotes the development of strong, productive lateral branches and avoids the need for supplemental support to keep the canes from falling to the ground.

Red raspberries and semi-erect and trailing blackberries, however, require some type of trellis to support their canes and fruit. Two basic types are in common use: the narrow, upright I-trellis and the wider, cross arm or T-trellis.

Upright trellises consist of 1 or 2 wires strung on posts spaced down the row. Floricanes are tied to the wires, either individually or in bunches. Temporary training wires may be used to pull primocanes into the row during the growing season to protect them from

mechanical damage. Present-day machine harvesters require that canes be supported by an upright trellis system for mechanical harvesting. Upright trellises also can be used to support trailing and semi-erect blackberries as well as red raspberries that are to be hand picked.

With the T-trellis, wires are strung along the ends of the cross arms, forming a corral around the canes. The canes can be tied to the wires or held up by “weaving” the canes on the wires. The T-trellis accommodates a larger number of canes in the row than the upright trellis and avoids the need to tie up the primocanes.

Fertilization

Nitrogen is the major fertilizer requirement of brambles. For commercial plantings of red raspberries and blackberries, rates of application range from 30 to 100 pounds of nitrogen per acre. Black and purple raspberries require lesser amounts. Commercial growers typically use trained observation, combined with soil and foliar testing, to determine fertilizer needs.

Deficiencies of boron, iron, magnesium, manganese, and zinc may reduce plant vigor and yields. Such deficiencies can often be diagnosed by leaf symptoms and confirmed by foliar analysis. Foliar sprays can be used to quickly correct such deficiencies and prevent further symptoms on new growth.

Fall cover crops, such as oats, barley, winter rye, and annual ryegrass, may be planted to use up excess nitrogen and soil moisture in the fall. This slows cane growth and promotes early maturation. Mature canes are more winter hardy than growing canes and, therefore, less likely to suffer winter injury.

Weed Control

Weeds are controlled in bramble plantings with the use of soil cultivation, chemical pesticides, and maintenance of a permanent cover crop. The most typical approach consists of using either mechanical cultivation or a permanent sod cover between the rows and chemical herbicides within the rows.

Harvesting

All berries destined for the fresh market are hand picked. The berries are picked directly into retail-size containers (pint or half-pint boxes) in which they are to be marketed. Pickers need careful training and supervision to assure high-quality berries. Since the berries are picked directly into the retail containers, the picker not only harvests the berries, but also grades them.

Berries for the processing market may be either hand picked or mechanically harvested. With mechanical harvesting, harvesters move through the field astraddle the rows, and rotary shakers knock the berries from the canes onto conveyor belts. The belts carry the fruit past workers who sort out trash (leaves and stems) and cull unwanted fruit.

Mechanical harvesting costs less than hand picking, but results in higher field losses. Machine harvesting reportedly results in yields that are 15-20 percent below those associated with hand picking. In addition, there is more physical damage to the fruit and greater opportunity for contamination by rot organisms when machine harvesting is used.

Handling

Harvested bramble fruit are very fragile and require careful and prompt handling. Flats containing the retail containers are palleted in the field to speed up the process and reduce the amount of handling. The flats are cooled promptly and kept cool until they reach market in order to preserve quality.

Berries for processing may be handled in flats or in poly-lined 55-gallon drums. The care with which fruit for processing is handled depends somewhat on its intended use. Berries to be used for juice may be handled in 55-gallon drums. Those intended for IQF (individually quick frozen) use or for freezing into block packages are handled in 7-10 pound plastic flats. As with fresh-market berries, berries for processing are refrigerated as soon as possible to prevent fruit rot and to maintain the fruit until processing.

Processing

Much of the fruit for the processing market is frozen in bulk containers for institutional use or is reprocessed into jams, jellies, preserves, pie filling, and yogurt. Some fruit is combined with sugar and used to fill retail packages. The best quality, whole fruit is preferred for IQF processing. Over-ripe and lower-quality fruit is usually destined for juice or wine. A small quantity of blackberries is canned for the retail market.

Marketing

More than 95 percent of the bramble fruit grown in Washington and Oregon is sold for processing. Although the usage breakdown between fresh market and processing is not reported, California brambles are grown mainly for the fresh market (Bettiga). Berries may be diverted to processing when fresh-market prices are low or if the berries are of low quality. Central California is an important fresh-market strawberry area and shippers use the fresh-market infrastructure developed for strawberries to handle and sell raspberries. Although statistics are not available for other states, the fresh market, especially direct-to-consumer sales, reportedly accounts for the bulk of marketings (Baker; Shane; Pritts).

Handling bramble fruit for the fresh market is a very specialized business requiring careful attention to all aspects of harvesting, handling, packaging, and shipping. The shelf life of bramble berries (the length of time the fruit remains in marketable condition after harvest) is shorter than for most fresh fruits and vegetables. Even with the least perishable berries, the length of time from harvest to market ranges from only a few days to a week or ten days at maximum, depending on how carefully they are harvested and handled.

Because blackberries and raspberries are so perishable, direct market outlets likely account for a larger share of fresh-market sales than for most fruits and vegetables. Pick-your-own operations, roadside stands, and farmers' markets all move berries from producer to consumer in a timely manner and with a minimum of handling.

Costs of Production

Cost of production budgets were located for raspberries in California, Oregon, and Michigan and for blackberries in Oregon (Table 9). Detailed budgets are contained in Appendix B.

Table 9--Bramble fruits: Costs of production

Item	Raspberries			Blackberries	
	Santa Cruz County, CA (1987 fresh market)	Oregon/Washington (processing)	Michigan (pick-your-own)	Oregon (1988)	
	Willamette[1]: *Heritage*[2]	*1993*	1988	Every-year production	Alternate-year production[3]
	Pounds				
Yield (pounds)	6,000	6,000	6,000	4,200	7,000	12,000
	Dollars per acre				
Cash expenses:					
Cultural	2,256	2,323	1,456	676	1,087	1,231
Harvest	7,023	7,023	576	447	980	1,680
Total	9,279	9,346	2,032	1,123	2,067	2,911
Ownership and overhead costs	2,481	616	1,785	228	607	1,147
Total costs	11,760	9,962	3,817	1,351	2,674	4,058

[1] Summer bearing variety.
[2] Primocane bearing variety.
[3] Expenses are the total for the two-year production cycle.

Sources: Elkins and Tyler; Turner and others; Burt and others; Kelsey and others.

The raspberry budgets for Santa Cruz County represent costs for commercial fresh-market production. Harvest expenses are relatively high because costs include hand picking and the cost for containers and flats. The notable difference in ownership and overhead for the 'Willamette' and the 'Heritage' varieties is due to a lower net establishment cost for 'Heritage.' Since 'Heritage' is a primocane bearing variety, it produces a crop during its establishment year, offsetting a portion of the establishment costs.

The Oregon budget, which also is representative for Washington, depicts costs for a commercial operation with at least 20 acres of berries intended for processing. Harvesting costs are considerably lower than in California because of the lower expenses associated with machine harvesting (including lower labor and packing material costs).

The Michigan raspberry budget represents expenses for a 10-acre planting. The berries are intended for a pick-your-own market and, therefore, the labor expense for harvesting is relatively small.

Two production systems are used for blackberries in Oregon: 1) every-year production and 2) alternate-year production. With every-year production, berries are harvested annually. With the alternate-year system, berries are harvested every second year. With this system, all the canes (floricanes and primocanes) are removed at the end of the harvest year and only primocanes grow during the following year. The every-year system produces more total production over a two-year period. However, the cost per pound of berries is lower with the alternate-year system because yields are higher in the bearing year and production costs average lower.

Producer Organizations

The Oregon Raspberry and Blackberry Commission

The Oregon Raspberry and Blackberry Commission is a state marketing order that supports research, promotion, and education for the Oregon bramble industry. Commission activities are supported through grower assessments of 1 percent of the value of all bramble berries sold off the farm. Since the Commission assesses growers on the basis of sales rather than the quantity of berries sold, it does not collect production data for individual farmers (Schroder).

The Washington Red Raspberry Commission

The Washington Red Raspberry Commission is a quasi-state government organization of commercial producers whose purpose is to support research and promotion for the raspberry industry. All Washington growers selling over 6,000 pound of raspberries annually are assessed ½ cent a pound on all berries sold. These assessments are used to support the Commission's activities (Seeger).

Processors report each producer's deliveries of berries to the Commission. These data could provide production histories for growers of processed berries. About half of the growers also submit production reports to the Commission, which include information on acreage harvested. The processor-reported production statistics, in combination with the grower-reported harvested acreage data, could provide a basis for estimating actual production histories for individual growers.

Production Perils

Winter injury reportedly is the most serious production peril for both raspberries and blackberries. An additional, frequently-cited cause of yield loss among raspberries is root rot, which occurs when the soil is excessively wet. Excessive rains and excessive heat in combination at harvest-time were cited as conditions that contribute to diseases and quality degradation, especially among raspberries. Brambles are also subject to a number of other perils, such as hail, wind, and various insect and disease pests.

Winter Injury

Plants are said to suffer winter injury when low temperatures kill fruit buds and damage or kill the canes and roots. The severity of damage depends on a number of factors, including the cultivar, the condition of the plant when the low temperatures occur, and the accompanying weather conditions. Canes are most hardy and can withstand cold temperatures most readily when they are fully dormant. They tend to be most vulnerable to winter damage when they are actively growing, such as after breaking dormancy in the early spring.

Although raspberries are more tolerant of severe winter weather than are blackberries, both species can incur winter injury due to extreme cold. In general, blackberries tend to be grown in areas with milder winter temperatures.

Raspberries and blackberries in the Pacific Northwest suffered considerable winter damage to the 1996 crop because of low temperatures during January and March. The region had periods of unseasonably warm temperatures that caused the canes to break dormancy early. These warm temperatures were followed by hard freezes and accompanying winds (an "arctic express") that killed a large number of fruit buds and retarded growth of lateral shoots.

Some raspberry fields in Whatcom County, Washington, reportedly had yield losses of 50 percent or more due to winter injury in that year (McConnell).

Excessive Rain

Excessive rain causes yield losses in several different ways. Fruit rot is the most common problem associated with wet, rainy weather at harvest-time (see the discussion of gray mold fruit rot in the "diseases" section). Root rot and plant drowning due to extended flooding also can cause yield losses. Consequently, growers may discard all of the fruit ripening during extended rainy periods.

Because of the highly contagious nature of gray mold rot, even fruit that appears healthy may harbor the gray mold spores and is likely to develop the disease after being harvested. In some cases, growers continue to harvest during wet weather, but drop the fruit to the ground rather than collect it. Then, after the weather clears, and the conditions for gray mold no longer exist, growers again collect the fruit. One contact estimated that untimely rainy periods at harvest can reduce yields by as much as 50 percent (McConnell).

Root rot (see the discussion of *Phytophthora* root rot in the "diseases" section) associated with wet soils is particularly serious among raspberries. Root rot was reported as a source of reduced yields in the Pacific Northwest during the 1996 season (McConnell; Brun; Strik).

Brambles may be killed by extended flooding, which essentially kills the plants' roots due to a lack of oxygen. Raspberries are less tolerant of flooding than blackberries.

Excessive Heat

Raspberries do not thrive under hot, dry conditions. The combination of heat, bright sun, and low humidity reduces fruit size and production and causes sunburn damage on exposed fruit. High temperatures cause the berries to dehydrate on the canes as they ripen. This situation reduces both the quality and the quantity of berries harvested.

In addition, excessive heat at, or near, harvest-time speeds up the ripening process, reducing the length of the harvest period. During such times, growers may not be able to harvest the berries as fast as they ripen, causing the fruit to become over-ripe and soft. Excessive heat at harvest-time is less of a problem with fall-bearing raspberries than with summer-bearing types. Fall-bearing raspberries mature over a longer time period, and temperature extremes usually occur prior to the harvest period.

Hail

Hail is not considered a serious production peril in the Pacific Coast states. Hail occurs less frequently on the West Coast than in

the central and eastern United States. In Texas, however, hail storms occur frequently, and at times cause serious damage to brambles (Baker).

Wind

Cold, dry winter winds desiccate bramble canes and exacerbate damage caused by extremely low temperatures. Cold, windy weather was cited as a cause of winter injury in the Pacific Northwest in 1996.

Strong winds during the fall and winter can also cause cane breakage in exposed fields, reducing the yield potential of the plants in the following year. Yield losses from cane breakage are, however, likely to be relatively small.

Sunburn

Hot, dry sunny conditions when the fruit is ripening can sunburn berries exposed to the direct sun. The individual drupelets on sunburned berries shrivel and dry up, making the berry unsuitable for commercial use. Blackberries can withstand summer heat better than raspberries, but they, too, can suffer yield and quality losses.

Insects

Insect populations tend to increase in bramble plantings over time, and are controlled with pesticide spray applications when they reach an economic-threshold level. The economic-threshold is the point at which the value of yield losses exceeds the cost of control. The major insect pests in bramble production are the raspberry crown borer, raspberry fruit worms, sap beetles, and Japanese beetles.

Raspberry Crown Borers--These insects attack all members of the *Rubis* family. The adult is a clear-winged, black and yellow moth which lays its eggs on the lower leaves of the bramble plant in late summer. When the larvae hatch, they fall to the ground, where they feed on the bark of the canes and eventually tunnel into the plant. Once in the crown and canes, they continue to feed for up to two years before they pupate and become adults.

The crown borer causes infected primocanes to wilt and die during midsummer. Because the insects infect individual canes, damage develops gradually over time. Further, because the borer feeds inside the crown and canes, its damage is easy to overlook, or the damage may be mistaken for a disease infection. Control consists of applying an insecticidal drench to the base of the plant after harvest or in the spring, killing young larvae as they feed prior to tunneling into the crown.

Raspberry Fruit Worms--Raspberry fruit worms are most often found on raspberries, although they sometimes also attack blackberries. The larvae tunnel into the receptacle of the fruit, causing the berries to drop from the plant. Alternatively, the larvae may remain in or on the fruit at harvest-time. In some plantings, more than half of

the berries may be infested with larvae. Berries arriving at the fresh market or processing plant with a noticeable presence of worms are likely to be rejected. Raspberry fruit worms are controlled by applying insecticidal sprays during the pre-bloom period or at the green fruit stage.

Sap Beetles--Sap beetles, also known as picnic beetles, bore into raspberries at picking time, eating portions of the fruit and laying eggs. Such damage leaves the fruit undesirable for human consumption. Sap beetle damage can be so extensive in some plantings that the fruit is unmarketable. Sap beetles generally can be controlled by removing damaged and discarded fruit from the field, since these are the attractants which cause a build-up in beetle populations.

Japanese Beetles--Adult Japanese beetles feed on the foliage, blossoms, and ripe fruit of both raspberries and blackberries. They especially like ripe berries which are exposed to sunlight. Infestation can be so serious that the fruit is unmarketable. The feeding of Japanese beetles can be controlled with insecticide applications.

Weekly inspections of the berries are needed from the beginning of harvest onward to monitor the potential for damage. This is because beetles can fly substantial distances from over-wintering sites (such as pastures) to re-infest a planting.

Diseases

Diseases generally cause more serious damage to bramble plants than do insects, and are also more difficult to control. While insect populations may be allowed to reach economically important levels before they are controlled, successful disease control depends on prevention. The most damaging bramble diseases are root rot, crown and root gall, *Verticillium* wilt, anthracnose, orange rust, gray mold fruit rot, rosette, and numerous viral diseases.

Phytophthora Root Rot--This root rot is a soil-borne fungal disease that attacks most red and purple raspberries cultivars, some black raspberry cultivars, and blackberries. It is most commonly associated with heavy, wet soils, but is not limited to these conditions. Infections spread from infected plants to adjacent plants and can kill entire sections of a planting.

The initial symptoms are wilting and die-back of the terminal portions of new primocanes during the early summer. Infected fruiting canes are frequently stunted, producing weak lateral shoots with leaves that yellow prematurely or scorch along the margins and between the veins. The symptoms increase in severity over one or two seasons and eventually the plant dies.

The keys to control are planting on sites with good soil drainage and avoiding soil contamination. The fungi are often introduced by the movement of contaminated soil from runoff water, farm equipment, or symptomless nursery stock. Since the fungus can be carried on either the soil or on the plants, growers should plant only certified stock from reliable nurseries which have no history of root rot. Careful machinery sanitation can also help prevent the introduction of infected soil into a field. New bramble plantings should be made on sites where brambles have not been previously grown in order to minimize the risk of infecting new plants.

Crown and Root Gall--Crown and root gall is a soil-borne bacterial disease that infects bramble plants, causing tumor-like masses on the roots, crowns, and canes. Galls are most often found on the roots and crowns of raspberries and on the canes of blackberries. Infections result in poor stands, weak growth, and lowered yields.

The best control is to prevent the introduction of infections into the field by planting gall-free stock. No effective methods exist for eradication once the plants and soil become infected.

Verticillium Wilt--*Verticillium* wilt is a fungal disease that severely damages black raspberries and, to a lesser extent, purple and red raspberries. Blackberries are also susceptible to the disease, but seldom suffer severe losses. Infected primocanes turn pale green or yellow during the summer and then appear to recover in the fall. The following spring, however, infected canes turn yellow, wilt, and die. After two or three seasons, the entire plant dies.

There is no cure for *Verticillium* wilt once infection occurs. Disease-free plants should be selected from a reliable nursery and planted in disease-free soil. Raspberries should not be planted in soils that have grown *Verticillium*-susceptible crops in the previous four to five years, including tomatoes, potatoes, peppers, and eggplants.

Anthracnose--Anthracnose is one of the most widespread fungal diseases affecting brambles in the United States. It is most destructive on black and purple raspberries, but also infects red raspberries and blackberries. Losses occur from defoliation, general stunting and decline in cane vigor, reductions in fruit yield and quality, and death of the canes. Infections are spread from old canes to new canes by spores carried by insects, splashing rain water, or wind.

Anthracnose thrives under cool, moist conditions and is difficult to control. Control begins with the planting of disease-free stock. Growers should follow strict sanitation practices to remove sources of the inoculum. In addition, production practices that promote good air movement within the planting can help prevent infections.

Orange Rust--Orange rust is a fungal disease that attacks most blackberries and both black and purple raspberries. Most red raspberries are resistant to the disease. The undersides of infected leaves develop blister-like pustules which turn powdery and bright orange. This bright orange, rusty appearance is what gives the disease its name. Infected plants normally do not die from the disease, but are weakened and produce little or no fruit.

The main control is to use resistant varieties. Destroying infected plants as soon as they show symptoms of infection in the spring helps reduce the spread of the disease to healthy plants.

Gray Mold Fruit Rot--This fruit rot is caused by the fungus *Botrytis cinerea*, and is the most widespread, costly disease that attacks brambles. Red raspberries are more susceptible than black raspberries and blackberries, but gray mold can reduce the shelf life of all bramble fruit. Infected fruit deteriorates rapidly, becoming watery and soft.

Prolonged rainy periods just prior to or during harvest can be potentially disastrous, creating ideal conditions for gray mold infections to develop. The spores that cause infection are nearly always present and infect ripe fruit and blossoms when moisture and temperature conditions are right.

Infected fruit is not suitable for shipment to fresh-market destinations as its shelf life is very limited. A good fungicidal spray program can help in controlling gray mold and other fruit rot diseases.

Rosette--Rosette, or double blossom, is a fungal disease of blackberries in the central and southern parts of the United States.

It is commonly found on erect blackberries and causes reduced yields, poor fruit quality, and death of the canes. The bloom is delayed in infected plants and the flowers are wrinkled, twisted, pinkish, and resemble double blossoms. Infected flowers either fail to set fruit or produce small, abnormal fruit.

Planting resistant cultivars helps control rosette in regions where it is a problem. Removing infected canes and applying fungicides at weekly intervals during blossoming also provides a measure of control.

Viral Diseases--Numerous viral diseases infect brambles. Black and purple raspberries are more seriously damaged than are either red raspberries or blackberries. Viral infections in raspberries reportedly can reduce fruit yields by 70 percent or more (Funt and others). Individual cultivars vary widely in susceptibility. Once established, it is impossible to eliminate most viruses from infected plants. The only control methods involve isolating healthy plants from sources of infection or eliminating the vector that transmits the virus from one plant to another. As a result, it is very important to use virus-free planting stock when establishing a new field.

Since black raspberries are very susceptible to damage, while many red raspberry cultivars can thrive with few or no symptoms, it is recommended that new black raspberry plantings be separated from red raspberries by at least 600 feet. This distance reduces the chances of insects, especially aphids, transmitting an infection from virus-tolerant red raspberries to virus-susceptible black raspberries.

Birds and Mammal Rodents

Fruit losses due to the feeding of birds and mammals on bramble fruit generally represents a minor nuisance. Some birds eat ripe berries, but the amount of fruit lost usually represents only a minuscule percentage of the total yield.

Deer were reported as a bramble pest in east Texas, where they forage on blackberry canes. Some growers in Texas build deer-proof fences around their plantings to protect blackberry plants (Baker).

State Analyses

California

The Census of Agriculture reported 266 California farms with 1,428 harvested acres of raspberries in 1992. In addition, 134 farms reported 410 harvested acres of blackberries and 116 farms reported 269 harvested acres of boysenberries. The farm value of bramble production in California was about $25 million in 1995 (USDA, NASS).

The bulk of California’s raspberries and blackberries are located in coastal valleys, where the ocean climate moderates summer

temperatures (Appendix table 9). The largest acreage is in Santa Cruz County. Commercial brambles are also produced in San Luis Obispo, Santa Clara, and Monterey counties. Summer temperatures in the interior valleys are too hot for raspberries.

In addition to commercial production, a number of farms located throughout the state have small bramble plantings. The output from these plantings is intended for local direct market outlets, such as farmers' markets and roadside stands. Some brambles are also grown on U-pick operations. California's boysenberry production is located in the San Joaquin Valley, notably in Fresno, Merced, San Joaquin, and Stanislaus counties.

California's commercial raspberry and blackberry production is destined for the fresh market. Virtually all commercial output is located in areas that also produce fresh-market strawberries, with shippers using their strawberry facilities for handling and selling bramble berries. A number of California's raspberry growers also produce strawberries.

Although California's bramble fruits are grown for the fresh market, at times net returns from the fresh market fall below those for processing. At such times, producers may sell their bramble fruits for processing (Bettiga).

The expected life of bramble plantings in California is 4 to 6 years, somewhat less that the 15 years reported in Washington and Oregon. This short life span is because fungal diseases and viruses reduce plant vigor sooner in California than in Oregon and Washington. Some growers in California are experimenting with an 18-month planting cycle, in which the plants are harvested for only one season and then replaced (Bettiga).

The most serious production peril for California producers is excessive rain during the winter and spring, which causes plant losses from root rot (Bettiga). Currently, growers are keenly aware of the potential for losses from excessive rain because of extensive flooding in the central coast area of California during the spring of 1995. Some growers lost up to 75 percent of their plants in the first year following this flooding. These losses were caused by plant drownings and root rot infections. Root rot infections tend to be more serious among raspberries than among blackberries.

Gray mold, the most serious raspberry disease in the U.S., is usually not a problem in California because the climate tends to be relatively dry during harvest-time. Most of the rain occurs during late fall, winter, and early spring, when raspberries are in their dormant phase.

Sunburn is a second source of yield loss among bramble fruits in California. In extreme cases, losses can be as high as 50-70 percent of the normal raspberry yield (Bettiga).

In contrast, hail is a minimal peril. California has few hail storms and yield losses due to hail are judged to be relatively light (Bettiga).

There is likely to be some interest in bramble insurance among California growers, especially following their experience with losses due to flooding in 1995. The University of California farm advisor for bramble fruits in Monterey County indicated that several growers had expressed frustration in not having crop insurance during the 1995 floods (Bettiga).

However, there appears to be limited potential for a crop insurance policy in California because of the relatively small value of the crop--$25 million in 1995. In fact, the insurable value is likely to be substantially less than this amount. The reason is that most of California's bramble fruits are sold for the fresh market, and the reported value of fresh-market berries embodies the costs associated with hand harvesting and with marketing, including the costs of boxes and cartons. Harvesting and marketing expenses accounted for 60 to 70 percent of the total cost of producing raspberries in California in 1987 (Table 9).

Oregon

Oregon is the number-one producing state for both blackberries and black raspberries. It ranks number two in red raspberry production, behind Washington. Oregon's bramble production is concentrated in five or six counties in the northern Willamette Valley (Appendix tables 10-15).

The Census of Agriculture reported 492 farms with 5,353 acres of raspberries (all types) in Oregon in 1992. Oregon produced 18.5 million pounds of red raspberries in 1995 and 2.6 million pounds of black raspberries. In addition, Oregon produced 37.5 million pounds of blackberries, 4.8 million pounds of boysenberries, and 0.3 million pounds of loganberries. The farm value of production for these five crops totaled $40.6 million in 1995.

Growers typically produce both raspberries and blackberries, and at times, other crops such as strawberries, vegetables, wheat, and grass seed (Strik; Brewster). Smaller producers tend to specialize in brambles, while farms with larger bramble acreages tend to be more diversified. Commercial plantings usually range from 5 to 150 acres in size, although 20-25 acres is typical.

A number of smaller bramble producers (those with 5-10 acres) are part-time farmers, having income from off-farm employment in addition to the sale of berries (Brewster). These small growers commonly run low-cash-outlay operations, relying on family labor for cultivation and harvesting. Small operations may hire a custom harvester for the main pickings and hand pick the later- maturing berries using family labor.

The most serious production perils among raspberries in Oregon are root rot and winter injury (Strik). Root rot tends to affect raspberries, and is usually not a problem with blackberries. In contrast, winter injury is more damaging among blackberries than among raspberries.

The Willamette Valley occasionally has an unusually wet spring which keeps the soils saturated for long periods. During such periods, root rot may develop in raspberry plantings, diminishing vigor and reducing yields. Some growers apply fungicides to the soil in an attempt to control root rot, reportedly with varying degrees of success.

Blackberries are grown under two different production systems in Oregon: 1) bearing every year, and 2) bearing in alternate years. Under the alternate-year system, the plants yield more berries per crop, but produce only one crop every two years. Consequently, the alternate-year system results in only about 85 percent as many berries over a two-year period as the every-year method. Total costs under the alternate-year system, however, are only about 75 percent as much as with the every-year system.

The alternate-year system provides growers with a measure of flexibility in dealing with winter damage. If their blackberries suffer severe injury, growers can remove the floricanes in the spring and skip that year's harvest. New primocanes grow during the summer and the producer harvests a larger crop the following season. As a result, an insurance policy would need to acknowledge that yield prospects for the season following winter damage are enhanced if growers skip a year's harvest.

As in California, Oregon bramble producers will likely have moderate interest in purchasing insurance. The most significant production perils are root rot among raspberries and winter damage among blackberries. With raspberries, however, yield losses usually represent a small portion of the potential yield and, in most cases, would not likely reach the 25-percent loss threshold required to trigger payments. With blackberries, growers can switch to an alternate-year harvesting system when their plants are damaged by cold temperatures and recoup part of their losses by harvesting a larger yield the following season.

The small amount of disaster assistance paid to Oregon bramble producers relative to their acreage suggests that growers incur relatively minor yield losses. Disaster payments for Oregon raspberries accounted for about 6.5 percent of the U.S. total over the 1988-94 period ($318,000), while the state had 34 percent of U.S. harvested acreage. For blackberries, disaster payments totaled $401,000 over the six-year period, nearly 17 percent of the U.S. total, while Oregon accounted for 65 percent of U.S. harvested blackberry acreage.

Even so, the potential for bramble insurance exists in Oregon. For some of the larger, commercial-size operations, a severe yield loss represents a substantial financial setback to the farming operation. Crop insurance could serve as an important risk management technique on such farms.

Texas

Blackberries are the major bramble crop in Texas. The 1992 Census reported that 350 Texas farms harvested 478,000 pounds of blackberries from 320 acres. The extension horticulturist in Overton, Texas, estimates that blackberry acreage was much higher than this in 1996, with perhaps as many as 800 acres in 20 eastern Texas counties and another 200-300 acres in central Texas (Baker). The blackberry acreage in east Texas has risen sharply in recent years as several new, disease-resistant varieties have become available.

The farm value of Texas blackberries is estimated at about $1-2 million annually. This estimate is based on the assumptions of 1,000 acres of berries yielding 1,500 pounds an acre, and selling for an average of $1.00 a pound.

The Census also reports 26 Texas farms harvesting 17 acres of raspberries in 1992. Texas Extension Service personnel indicate that acreage has increased somewhat in recent years with the introduction of a new, heat-tolerant variety named 'Dorman Red.'

About one-half of the east Texas blackberry acreage is irrigated. Irrigation provides protection against drought, but little or no protection against freeze damage. Plants are not protected from freeze damage because growers use a drip emitter system that does not wet the plants.

Blackberries in Texas are grown almost exclusively for the fresh market, and a high proportion of the crop is sold through direct marketing outlets. East Texas is near several major population centers (including Dallas-Fort Worth, Austin, Houston, and San Antonio) that serve as a source of demand for roadside stands, farmers' markets, and U-pick operations. A small percentage of Texas blackberries are also sold for processing into specialty jellies and jams.

Blackberries are commonly retailed in covered ½ pint containers. Prices range from $14-$22 per flat, containing 12 half-pints. U-pick operations typically charge $4-$6 per gallon, or about 70 cents a pint.

Most blackberry plantings in Texas cover 1 to 5 acres. With the adoption of the newer disease-resistant varieties, however, a few larger plantings (30-50 acres) have been established (Baker). Typically, farms with blackberries also grow other horticultural crops, including peaches, blueberries, raspberries, and a number of vegetables. This diversification allows growers to offer a mix of produce to their direct-market customers. Diversification also provides a measure of risk protection against crop failure.

The most serious perils in Texas include freezing temperatures during the spring bloom period, hail damage, and drought (Baker). Usually, winter temperatures in east Texas do not fall low enough to damage the blackberry canes. However, late spring freezes frequently occur while blackberries are in bloom, killing the blossom buds.

Hail frequently occurs in Texas and can cause varying degrees of damage. Severe hail shreds the blackberry leaves, bruises the immature berries, and can destroy the mature fruit.

Drought damage can also affect yields. Extreme dryness during the spring and early summer reduces the size of the berries, lowering current-year yields. In addition, dry conditions during the summer and fall can diminish the subsequent season's yield potential by reducing the number and vigor of the primocanes (the new canes) produced by the plants.

Some of the larger bramble growers in Texas would likely purchase bramble insurance beyond the catastrophic (CAT) level, as yield losses can cause substantial financial setbacks. Nevertheless, there

is only a limited potential for bramble crop insurance in Texas because of the modest acreage and the associated low crop value. Blackberries are the most significant bramble crop, with a crop value estimated at less than $2 million annually. In addition, diversification with other fruit and vegetable crops and off-farm employment serve somewhat as a risk management tool for bramble growers.

Washington

Red raspberries are the only bramble crop of significance in Washington. The Census reported more than 5,000 acres of red raspberries for the state in 1992, but only 6 acres each of boysenberries and loganberries. Neither the Census nor USDA report production of blackberries other than boysenberries and loganberries in Washington.

Washington is the major U.S. red raspberry state, producing 52.5 million pounds from 5,900 acres in 1995. The farm value of the crop was $35 million. Washington's red raspberry acreage rose sharply between 1985 and 1995, likely the result of high world prices for frozen raspberries. USDA did not report black raspberry production for Washington after 1988, but at that time, the state produced only about 100,000 pounds annually.

Two-thirds of Washington's raspberries are located in Whatcom County in northwest Washington. Whatcom County's advantage in producing red raspberries stems from its cool summers, moderate winters, and deep, well-drained soils (McConnell).

Clark and Cowlitz counties in southern Washington also produce raspberries, with Clark County having the larger acreage. Clark County reportedly had about 30 commercial producers and about 1,100 acres of raspberries in 1996 (Starbuck; Brun). About 95 percent of Clark County's raspberries are destined for processing and 80 percent are machine harvested. The berries are planted on land that has been drained to lower the water table to at least three feet below the surface. Nevertheless, some Clark County plantings experienced a high incidence of root rot in 1996, following prolonged flooding that spring.

Ninety-eight percent of the state's raspberries were processed in 1995. Most of the remaining production is sold fresh to local markets. Only a few Washington producers are equipped to handle and sell raspberries in the national fresh market. Those who do so usually handle raspberries along with other berries, including strawberries and blackberries.

The Census reported 359 farms in Washington with raspberries in 1992. Relatively few of these, however, account for the bulk of production. The "commercial" producers in Whatcom County have holdings ranging from 20-25 acres to 500 or more acres. Growers reportedly need at least 20-25 acres to justify the investment in a mechanical harvesting machine (McConnell). Those with fewer than 20 acres

likely hand pick their berries or have them custom harvested. Some small producers sell in the local fresh market.

'Meeker' is the dominant variety grown in Whatcom County, having replaced 'Willamette' as the most widely-grown cultivar. A small amount of acreage is planted with the 'Tulameen' and 'Chilliwack' varieties.

The most damaging production peril in Whatcom County is winter damage (Carkner; McConnell). Winter damage occurs when cold, dry winds desiccate the dormant canes, killing buds and, at times, entire canes. Winter damage is limited to the subsequent season as the raspberry roots remain unharmed by the cold weather and produce a normal growth of primocanes the following summer. Winter damage reportedly can reduce yields 50 percent or more below normal in hard-hit fields, and was a significant cause of loss in the winter of 1995/96.

Excessive rain is cited as the second-most-likely cause of yield loss in Washington. Too much rain at harvest-time can result in uncontrolled outbreaks of gray mold fruit rot. During gray mold outbreaks, growers usually continue the harvest process, but shake the fruit to the ground rather than collect the berries. When subsequent dry weather reduces the incidence of gray mold infection, growers again collect the ripe fruit. Because gray mold outbreaks do not usually last for the entire harvest period, the entire crop is not likely to be lost. If the infection begins early in the season, up to 50 percent of the crop may be lost. This would, however, represent an extreme situation (McConnell).

A second source of loss associated with excessive rain occurs when plants die due to root rot infections. Root rot problems are most prevalent on poorly drained soils. Raspberry production has been unusually profitable in the past several years, and some growers have, as a consequence, planted berries on poorly drained soils where root rot problems are more likely to occur.

Disaster assistance data indicate that Washington has experienced a relatively low incidence of sizeable yield losses. Between 1988 and 1994, disaster payments for raspberries totaled $374,000 in Washington, about 8 percent of the U.S. total. In comparison, the state accounted for 33 percent of U.S. harvested acreage.

Washington has potential for bramble crop insurance, particularly for raspberries, because of the large acreage and high value of production. In addition, a number of growers in Washington are sufficiently specialized in bramble production that yield losses represent a severe financial setback to their farming operations. Such growers would likely purchase bramble insurance beyond the catastrophic level to protect themselves against large financial losses.

Midwestern and Northeastern Raspberries

The largest raspberry acreage outside the Pacific Coast states is in Michigan, New York, Wisconsin, Pennsylvania, and Minnesota. Most of the raspberries in these states are in small plantings of five or fewer acres. The berries are sold through U-Pick operations, roadside stands, or other direct market outlets, with a few marketed through local grocery stores. There are a few "larger" growers (with 5 acres or more) in southwest Michigan who sell to a local jam processor.

Midwestern and Northeastern growers produce a mix of summer-bearing and primocane or fall-bearing varieties in order to extend their marketing season. One contact estimated that about two-thirds of the raspberries in New York are the summer-bearing type and one-third are fall-bearing (Pritts). In Michigan, the fall-bearing 'Heritage' variety accounts for the majority of the acreage (Hanson). By growing both summer-bearers and fall-bearers, the marketing season can be extended over several months. Producers usually grow raspberries along with a mix of other fruits and vegetables (strawberries, sweet corn, pumpkins, tomatoes, and other crops) so that they can offer a variety of products for their customers.

The most serious production perils include extremely low winter temperatures and extended periods of rainy weather at harvest-time (Pritts; Shane). Unless the raspberry canes are protected by a deep snow cover, extremely low temperatures, especially if accompanied by dry winds, may kill dormant flower buds and may even kill the canes. This winter damage is only a problem with the summer-bearing raspberries, as the canes of the fall-bearers can be removed before winter and, therefore, are not exposed to the winter cold.

Extended periods of warm, wet weather, especially during the bloom period and just prior to harvest, may lead to uncontrolled gray mold outbreaks. Gray mold infects the blossoms and young fruit, and can spread quickly to healthy berries during wet weather. Because fall-bearing raspberries bloom and mature over a longer period, gray mold is usually less serious than for the summer-bearers. After the weather becomes drier, fall-bearing varieties produce healthy fruit from new blossoms that are not infected with mold. Because of the short harvest period, an infection at harvest-time among summer-bearing varieties may destroy a large part of the crop.

Midwestern and Northeastern bramble producers have some of the highest yield losses in the country. With only 4.2 percent of the raspberry acreage, Michigan growers collected 36.8 percent of the disaster assistance payments made for raspberries over the 1988-94 period.[4] Other states collecting disproportionately large disaster assistance payments, such as Illinois, Indiana, Minnesota, New

[4] The share of acreage for those states reporting disaster payments is based on Census harvested area in 1992. The share of disaster payments is for 1988-94.

Jersey, New York, and Pennsylvania, also are located in the Midwest and Northeast.

Southern States (Blackberries)

Small plantings of red raspberries and blackberries are scattered throughout the South, although most raspberry cultivars are not well-adapted to hot summers and warm winters. Several erect types of blackberries have been bred specifically for Arkansas, Oklahoma, and Texas, and do well in those locations. The largest concentration of acreage in the South is in Texas (see the "Texas" section). Most bramble production in the South is sold locally for the fresh market.

Ad Hoc Disaster Assistance for Brambles

Ad hoc disaster payments were made available to raspberry and blackberry growers for losses due to natural causes in each of the years 1988 to 1994. Since raspberries and blackberries were not eligible for crop insurance in those years, producers were required to realize a yield loss of at least 40 percent in order to be eligible for ad hoc disaster payments.

Data on ad hoc disaster payments provide an indication of potential high-loss areas. The states and counties with large ad hoc payments from 1988 to 1994 are most likely to face a relatively high risk of loss under a potential Risk Management Agency policy for brambles, and would likely have a relatively high demand for crop insurance.

Disaster assistance payments for raspberry losses totaled $4.9 million over the 1988-94 period (Table 10). The largest payments were made to Michigan growers, who received nearly 37 percent of total U.S. payments over the six-year period. These payments were due primarily to drought, cold damage, and extreme heat and extended rains during harvest. They were large compared to the state's 4 percent of U.S. acreage. Payments to raspberry growers in Oregon and Washington were relatively low, (at 6 and 8 percent of the U.S. total, respectively), particularly when compared with their share of U.S. harvested acreage (with each state accounting for about one-third of the U.S. total).

Over the 1988-94 period, payments for blackberry losses totaled $2.4 million (Table 11). States receiving a disproportionate share of payments relative to their acreage include Tennessee (receiving 20 percent of the total), Arkansas (12 percent), and Mississippi (8 percent). These states each accounted for 1-3 percent of U.S. blackberry acreage in 1992. In contrast, Oregon received nearly 17 percent of the U.S. disaster payments over the period, but accounted for about 65 percent of the U.S. blackberry acreage.

Insurance Implementation Issues

Demand for Insurance

The greatest interest among growers in bramble crop insurance is likely to arise in the north central and northeastern United States, where growers frequently incur large yield losses. This is indicated by ad hoc disaster assistance data for states such as Michigan, Minnesota, New York, and New Jersey, which received disproportionately large shares of total U.S. payments over the 1988-94 period. Growers in these states have relatively large yield losses due to weather-related perils, and crop insurance could be an important risk management tool for them.

The potential for crop insurance in these states is limited, however, because of the small amount of acreage and low value of production. Michigan, the largest bramble producer outside the Pacific Coast states, reported only 667 acres of raspberries and 63 acres of blackberries in 1992 and less then 1 million pounds of bramble fruit output. Other Midwestern and Northeastern states reported substantially less acreage in 1992.

Table 10--Disaster assistance payments for raspberries, 1988-94

State	Acreage harvested, 1992	Share of U.S. acreage[1]	Total disaster payments, 1988-94	Share of U.S. disaster payments
	Acres	Percent	$1,000	Percent
Arkansas	18	0.1	17.1	0.35
California	1,428	9.0	53.8	1.10
Colorado	62	0.4	4.5	0.09
Connecticut	76	0.5	21.1	0.43
Georgia	8	0.1	19.0	0.39
Idaho	80	0.5	7.5	0.15
Illinois	101	0.6	201.3	4.10
Indiana	93	0.5	100.6	2.05
Iowa	53	0.3	29.4	0.60
Kansas	6	*	4.1	0.08
Kentucky	20	0.1	7.1	0.15
Maine	116	0.7	40.8	0.83
Maryland	70	0.4	17.1	0.35
Massachusetts	140	0.9	47.9	0.98
Michigan	667	4.2	1,807.4	36.80
Minnesota	222	1.4	358.8	7.31
Missouri	48	0.3	18.8	0.38
Nebraska	28	0.2	6.2	0.13
New Hampshire	96	0.6	8.1	0.17
New Jersey	118	0.7	190.1	3.87
New York	472	3.0	291.8	5.94
North Carolina	30	0.2	6.4	0.13
North Dakota	11	0.1	5.3	0.11
Ohio	370	2.3	189.9	3.87
Oregon	5,353	33.9	317.9	6.47
Pennsylvania	240	1.5	229.0	4.66
South Dakota	7	*	14.6	0.30
Tennessee	25	0.2	6.3	0.13
Texas	17	0.1	11.2	0.23
Utah	135	0.9	32.5	0.66
Vermont	54	0.3	8.7	0.18
Virginia	44	0.2	9.1	0.19
Washington	5,283	33.4	373.7	7.61
West Virginia	29	0.2	16.0	0.33
Wisconsin	277	1.8	437.3	0.91
35 states	15,797	100.8	4,910.7	100.0

* less than 0.05 percent. [1] May not add due to rounding.

Sources: Department of Commerce, Bureau of the Census and FSA data files, compiled by the General Accounting Office.

Table 11--Disaster assistance payments for blackberries, 1988-94

State	Acreage harvested, 1992	Share of U.S. acreage	Total disaster payments, 1988-94	Share of U.S. disaster payments
	Acres	Percent	$1,000	Percent
Alabama	89	1.3	40.4	1.7
Arkansas	68	1.0	294.0	12.1
California	410	6.0	34.4	1.4
Colorado	na	na	0.3	*
Georgia	77	1.1	4.9	0.2
Idaho	7	0.1	0.1	*
Illinois	64	0.9	114.6	4.7
Indiana	22	0.3	40.3	1.7
Iowa	5	0.1	1.5	0.1
Kansas	10	0.1	8.1	0.3
Kentucky	79	1.2	35.9	1.5
Louisiana	54	0.8	36.1	1.5
Michigan	63	0.9	112.6	4.6
Mississippi	70	1.0	193.6	8.0
Missouri	130	1.9	134.7	5.6
New Hampshire	2	*	1.3	0.1
New Jersey	38	0.6	7.9	0.3
New Mexico	2	*	0.7	*
New York	29	0.4	2.5	0.1
North Carolina	111	1.6	10.8	0.4
Ohio	85	1.2	23.2	1.0
Oklahoma	111	1.6	113.7	4.7
Oregon	4,442	64.9	401.4	16.5
Pennsylvania	40	0.6	13.3	0.5
South Carolina	75	1.1	46.2	1.9
Tennessee	178	2.6	485.9	20.0
Texas	320	4.7	209.2	8.6
Virginia	97	1.4	26.6	1.1
Washington	120	1.8	29.1	1.2
West Virginia	19	0.3	2.7	0.1
Wisconsin	25	0.4	0.1	*
31 states	6,842	100.0	2,426.0	100.0

* less than 0.05 percent. na = not available.
Source: Department of Commerce, Bureau of the Census and FSA data files, compiled by the General Accounting Office.

Because of their large commercial acreage, the greatest potential for bramble crop insurance exists in California, Oregon, and Washington. For some of the larger, commercial-size operations, a severe yield loss represents a substantial financial setback to the farming operation. Crop insurance could serve as an important risk management technique on such farms.

Some growers in Washington have indicated an interest in bramble insurance. The Farm Service Agencies in Clark and Whatcom counties, for example, report that they have received requests for raspberry insurance and that growers have asked about the availability of such insurance (Jaquish; Starbuck). Production perils were of particular concern in 1996, when substantial crop losses occurred due to winter damage. In addition, some growers in Clark County, Washington, lost raspberry plants due to flooding in 1996.

The Marion County, Oregon, Farm Service Agency Executive Director indicated that he had not received any requests for crop insurance for brambles (Brewster). However, he thought that if insurance were available some producers, especially the largest ones, would purchase it because “brambles are a high-risk crop.”

The extension farm advisor for brambles in Monterey and Santa Cruz counties in California indicated that several growers had expressed frustration that they did not have crop insurance available during flooding in the spring of 1995. Unusual flooding along the central California coast caused severe damage to a wide range of crops in 1995.

Adverse Selection

A major source of loss among raspberries planted on poorly-drained soils is the debilitation and death of plants due to flooding and root rot infections. Consequently, the soil type and its elevation relative to potential flood waters play an important role in determining the chances of yield losses. Several contacts indicated that “new” growers sometimes plant raspberries on heavy, poorly-drained soils, and that the probability of losses due to flooding and root rot are higher among these plantings than among plantings on better sites. Growers planting raspberries on heavy, poorly-drained soils, and whose premium rates are not adjusted accordingly, are likely to expect higher returns from crop insurance than growers with more desirable planting sites. Therefore, such growers may be more likely to purchase insurance.

Adverse selection may also exist in situations where drought damage to brambles during the summer weakens the plants and diminishes the number of primocanes. Growers may be more likely to purchase crop insurance for the following year when their plants have been weakened by summer drought. They may reason that their chances of a crop failure rise due to the weakened plants. This situation would occur most frequently in drought-prone areas where brambles are not irrigated. Summer drought damage was cited as a production peril among blackberries in Texas.

Reference Prices

The state agricultural statistics services in Washington and Oregon report state average prices received by farmers for fresh-market and processing raspberries. The Oregon Agricultural Statistics Service also reports average fresh-market and processing prices for blackberries (including prices for loganberries and boysenberries). The price reported in California is an all-raspberry price and represents returns for fresh-market and processing berries. Since the bulk of California's sales are for the fresh market, the all-raspberry price more closely represents a fresh-market price than a processing-berry price.

Fresh-market berry prices tend to run higher than the prices for processing berries because they embody returns for services and supplies (including packing, grading, selling, and containers) not embedded in the returns for processing berries. In addition, harvesting expenses for fresh market berries exceed those for processing berries because of the need for hand picking. Hand picking expenses run substantially higher than machine harvesting costs.

The average prices reported by the agricultural statistics services represent a reasonable basis for setting price elections. Because berry prices embody returns for a substantial amount of harvesting and marketing expenses, the in-field value of production is, however, substantially less than indicated by reported market prices.

Estimating "Appraised Production"

Appraised production refers to output that is not destroyed by an insurable peril. As with a number of crops, estimating appraised production for brambles will require a great amount of subjective judgment on the part of the insurance adjuster, particularly regarding whether production went unharvested because of damage by an insurable peril or because of market conditions.

One example is the case where gray mold fruit rot infects the berries. Occasionally, growers discard all of the fruit maturing during a gray mold outbreak, regardless of whether or not the individual berries are infected. This is more likely to happen during periods of low market prices, when the cost of separating infected berries from healthy berries exceeds the returns for the harvested fruit. Whether or not the production losses are due to gray mold or to low market returns is a subjective judgment which the insurance adjusters would have to make.

A second example where insurance adjusters would be faced with making a subjective judgment is when growers remove the canes in the spring following winter damage. In such situations, the grower incurs a complete yield loss in the current season, but may expect a larger than normal crop in the subsequent season.

Moral Hazard

Moral hazard occurs when a grower intentionally (either through neglect or overt actions) contributes to causing a yield loss. Generally, moral hazard incentives exist when net market returns from the additional yield fall below the returns from collecting crop insurance. This situation is most likely to occur during periods of low market prices and when the crop yield is somewhat marginal.

Moral hazard is not likely to be a widespread problem in offering bramble insurance because, in the major producing areas, most production is concentrated in a relatively small area. In western Washington and Oregon, the low market returns usually associated with moral hazard would be most likely to occur during seasons when growers had relatively high average yields. Conversely, during years with low yields, market prices are likely to exceed the price election, diminishing the chances that a moral hazard incentive exists.

Estimating Actual Production History (APH)

The production and acreage data reported to the Washington Red Raspberry Commission by processors and producers provide a means for estimating APH for growers. In Washington, the Raspberry Commission requires processors to report the pounds of berries delivered by each producer. These data could provide growers' production histories for processed berries. About half of the growers reportedly also submit reports to the Commission which include information on harvested acres. The processor-reported production statistics, in combination with the grower-reported harvested acreage data, could provide a basis for estimating the APH for growers.

California and Oregon do not have the production data available on an individual-producer basis that is available in Washington. Commercial growers in these states, however, are likely to have adequate records on acreage, as well as documentation on the output delivered to processors or handlers. These data could be used to establish yield histories.

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Appendix table 1-- Raspberries: Number of farms, acres harvested, and acres irrigated, 1987 and 1992

State/County	1992				1987			
	Farms	Acres	Farms irrigated	Acres irrigated	Farms	Acres	Farms irrigated	Acres irrigated
California	266	1,428	266	1,428	258	1,330	258	1,330
Monterey	46	501	46	501	58	351	58	351
Santa Cruz	57	580	57	580	75	750	75	750
Ventura	15	139	15	139	8	66	8	66
Other	148	208	148	208	117	163	117	163
Michigan	357	667	170	361	375	861	162	428
New York	318	472	117	173	300	497	96	204
Ohio	224	370	61	116	224	435	70	232
Oregon	492	5,353	322	2,724	496	5,754	271	2,637
Clackamas	154	2,093	52	616	199	2,626	55	692
Linn	26	377	23	358	27	438	23	322
Marion	38	583	27	510	42	333	34	284
Multnomah	40	804	19	91	148	974	13	176
Polk	9	137	9	13	9	89	7	85
Washington	49	1,077	37	821	42	829	32	752
Other	176	282	155	315	29	465	107	326
Washington	359	5,283	252	4,502	400	4,185	232	3,088
Clark	42	626	24	355	47	443	24	200

Cowlitz	9	259	6	257	8	na	6	na
Skagit	29	412	13	225	36	547	11	211
Whatcom	95	3,535	89	3,419	91	2,168	75	2,047
Other	184	451	120	246	218	na	116	na
Other	2,623	2,326	1,082	1,183	2,244	2,422	925	1,226
U.S.	4,639	15,899	2,270	10,487	4,297	15,484	2,014	9,145

Source: U.S. Department of Commerce, Bureau of the Census. 1992.

Appendix table 2--Blackberries: Number of farms, acres harvested, and acres irrigated, 1987 and 1992

State/County	1992				1987			
	Farms	Acres	---Irrigated--- Farms	Acres harvested	Farms	Acres	---Irrigated--- Farms	Acres harvested
California	134	410	134	410	108	345	108	345
Santa Cruz	19	255	19	255	18	199	18	199
Other	115	155	115	155	90	146	90	146
Oregon	403	4,442	316	3,752	402	4,472	310	3,745
Clackamas	83	821	60	607	06	754	56	543
Marion	185	2,263	149	1,923	206	2,353	172	2,164
Washington	32	711	27	633	28	910	21	678
Other	103	647	80	589	82	455	61	360
Texas	350	320	169	150	226	240	101	87
Other	1,732	1,822	707	861	1,350	1,622	502	670
U.S.	2,619	6,994	1,326	5,173	2,086	6,679	1,021	4,847

Source: U.S. Department of Commerce, Bureau of the Census. 1992.

Appendix table 3--Boysenberries: Number of farms, acres harvested, and acres irrigated, 1987 and 1992

State/County	1992				1987			
	Farms	Acres	Irrigated: Farms	Irrigated: Acres harvested	Farms	Acres	Irrigated: Farms	Irrigated: Acres harvested
California	116	269	116	269	107	386	107	386
Fresno	13	52	13	52	15	119	15	119
San Joaquin	5	56	5	56	3	--	3	--
Stanislaus	4	82	4	82	7	105	7	105
Other	94	79	94	79	82	162	82	162
Oregon	220	821	174	708	228	787	176	626
Clackamas	50	170	34	130	42	101	30	80
Marion	101	441	85	399	137	577	114	486
Other	69	210	55	179	49	109	32	60
Washington	9	6	5	3	6	14	5	7
Other	2	--	1	--	9	11	5	8
U.S.	347	--	296	--	350	1,198	293	1,027

-- = Not available.

Source: U.S. Department of Commerce, Bureau of the Census. 1992.

Appendix table 4--Loganberries: Number of farms, acres harvested, and acres irrigated, 1987 and 1992

State/County	1992				1987	
	Farms	Acres harvested	Farms	Acres harvested	Farms	Acres harvested
			Irrigated		Irrigated	
California	1	--	1	--	--	--
Oregon	48	81	41	58	79	234
Clackamas	8	21	4	4	18	--
Marion	34	59	32	52	51	145
Other	6	2	5	1	--	--
Washington	14	6	9	2	4	--
U.S.	63	--	51	--	84	240
			62	135		

-- = Not available.

Source: U.S. Department of Commerce, Bureau of the Census. 1992.

Appendix table 5--Size distribution of farms producing raspberries, selected states, 1987

State	All farms	$500,000 or more	$100,000 to $499,000	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number					
California	258	17	29	15	39	158
New York	300	3	36	19	33	209
Oregon	496	16	67	48	60	305
Washington	400	12	46	40	37	265
Wisconsin	217	0	7	13	20	177
Other	2,626	30	177	191	215	2,013
United States	4,297	78	362	326	404	3,127
	Number	Percent of farms				
California	258	7	11	6	15	61
New York	300	1	12	6	11	70
Oregon	496	3	14	10	12	61
Washington	400	3	12	10	9	66
Wisconsin	217	0	3	6	9	82
Other	2,626	1	7	7	8	77
United States	4,297	2	8	8	9	73

Source: U.S. Department of Commerce, Bureau of the Census. 1987.

Appendix table 6--Size distribution of farms producing blackberries, selected states, 1987

State	All farms	$500,000 or more	$100,000 to $499,000	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number					
California	108	7	19	2	10	70
Oregon	402	16	56	52	60	218
Washington	45	1	7	3	1	33
Other	1,531	10	76	72	98	1,275
United States	2,086	34	158	129	169	1,596
	Number	Percent of farms				
California	108	6	18	2	9	65
Oregon	402	4	14	13	15	54
Washington	45	2	16	7	2	73
Other	1,531	1	5	5	6	83
United States	2,086	2	8	6	8	77

Source: U.S. Department of Commerce, Bureau of the Census. 1987.

Appendix table 7--Size distribution of farms producing boysenberries, selected states, 1987

State	All farms	$500,000 or more	$100,000 to $499,000	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number					
California	107	3	19	5	5	75
Oregon	228	6	23	29	36	134
Other	15	0	1	1	0	13
United States	350	9	43	35	41	222
	Number	Percent of farms				
California	107	3	18	5	5	70
Oregon	228	3	10	13	16	59
Other	15	0	7	7	0	87
United States	350	3	12	10	12	63

Source: U.S. Department of Commerce, Bureau of the Census. 1987.

Appendix table 8--Size distribution of farms producing loganberries, selected states, 1987

State	All farms	$500,000 or more	$100,000 to $499,000	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number					
Oregon	79	3	5	11	12	48
	Number	Percent of farms				
Oregon	79	4	6	14	15	61

Source: U.S. Department of Commerce, Bureau of the Census. 1987.

Appendix table 9--Bushberry acreage, yield, and production in California, selected counties,
1991-93

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	--------Tons--------		$/ton	$1,000
San Luis Obispo	1991	50	4.6	234	3,521	824.0
	1992	48	4.8	235	3,591	844.0
	1993	34	6.5	223	3,233	721.0
	1994	46	5.4	248	3,335	827.0
Santa Clara	1991	31	5.5	171	2,040	349.0
	1992	30	5.5	165	1,903	314.0
	1993	33	8.0	264	1,954	516.0
	1994	34	8.0	272	1,750	476.0
Santa Cruz	1991	244	7.2	1,767	1,451	2,564.0
	1992	344	11.8	4,078	729	2,973.0
	1993	259	4.7	1,223	1,431	1,751.0
	1994	262	4.7	1,223	2,000	2,446.0
Monterey	1991	66	5.9	393	2,854	1,122.0
	1992	82	8.9	730	1,831	1,337.0
	1993	36	7.5	273	2,216	605.0
	1994	11	4.7	52	1,748	90.9
California	1991	408	6.2	2,566	1,920	4,927.6

1992	535	9.7	5,209	1,098	5,720.2
1993	479	4.1	1,984	2,262	4,489.1
1994	494	5.1	1,796	2,138	4,673.3

Source: California Agricultural Statistics Service. County Agricultural Commissioners' Reports.

Appendix table 10--Red Raspberry acreage, yield, and production in Oregon, selected counties,
1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	1,700	5,500	9,350	53.1	4,966
	1993	1,500	4,380	6,567	70.4	4,623
	1994	1,550	5,810	9,000	89.2	8,020
	1995	1,620	4,600	7,457	76.4	5,697
Marion	1992	450	5,400	2,430	53.1	1,291
	1993	400	4,410	1,763	70.0	1,234
	1994	420	5,710	2,400	89.2	2,141
	1995	450	4,600	2,072	76.5	1,585
Multnomah	1992	830	5,400	4,482	53.1	2,380
	1993	900	4,390	3,510	72.0	2,527
	1994	800	5,690	4,551	90.2	4,107
	1995	830	4,600	3,821	76.4	2,919
Polk	1992	80	5,300	424	54.0	229
	1993	80	4,300	344	70.1	241
	1994	85	5,710	485	91.3	443
	1995	85	4,600	391	79.5	311
Washington	1992	410	5,700	2,337	53.1	1,242

	1993	430	4,450	1,913	70.5
1,349					
	1994	440	5,800	2,552	90.2
2,303					
	1995	460	4,600	2,118	76.4
1,618					
Oregon	1992	4,000	5,500	22,000	54.0
11,880					
	1993	3,700	4,460	16,500	70.9
11,695					
	1994	3,800	5,790	22,000	89.7
19,735					
	1995	4,000	4,630	18,500	77.0
14,250					

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix table 11--Black Raspberry acreage, yield, and production in Oregon, selected counties,
1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	400	2,200	880	148.1	1,303
	1993	430	2,470	1,060	161.2	1,709
	1994	430	3,300	1,421	100.3	1,425
	1995	445	2,120	944	60.4	570
Lane	1992	30	1,900	57	145.6	83
	1993	30	1,570	47	161.7	76
	1994	30	2,700	81	100.0	81
	1995	30	2,070	62	61.3	38
Marion	1992	60	2,000	120	148.3	178
	1993	60	2,550	153	160.8	246
	1994	60	3,300	198	100.5	199
	1995	70	2,140	150	60.0	90
Washington	1992	510	2,240	1,142	148.1	1,691
	1993	530	2,460	1,306	161.3	2,106
	1994	530	3,350	1,776	100.3	1,781
	1995	550	2,130	1,173	60.4	708
Yamhill	1992	50	2,100	105	147.6	155

	1993	50	2,460	123	161.0
198					
	1994	50	3,360	168	100.0
168					
	1995	55	2,150	118	60.2
71					
Oregon	1992	1,100	2,180	2,400	148.1
3,554					
	1993	1,150	2,430	2,800	161.2
4,514					
	1994	1,150	3,300	3,800	100.3
3,810					
	1995	1,200	2,130	2,550	60.4
1,540					

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix table 12--Marion and other blackberry acreage, yield, and production in Oregon,
selected counties, 1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	550	8380	4938	53.1	3621
	1993	580	5480	3176	31.0	986
	1994	700	7070	4948	35.3	1748
	1995	710	5800	4118	56.0	2306
Marion	1992	1500	8600	12895	52.6	6780
	1993	1600	5500	8795	30.9	2721
	1994	1730	7070	12228	35.3	4319
	1995	1750	6800	11900	56.0	6664
Multnomah	1992	110	8480	933	53.6	500
	1993	110	5500	605	32.1	184
	1994	110	7060	777	36.3	282
	1995	110	6800	748	56.0	419
Polk	1992	150	8380	1257	53.6	674
	1993	130	5500	715	31.0	222
	1994	150	7070	1060	35.3	374
	1995	160	6800	1088	55.9	609
Washington	1992	600	9280	5566	53.1	2955

	1993	620	6480	4016	32.0
1287					
	1994	650	7070	4594	35.3
1623					
	1995	670	5800	3886	56.0
2176					
Yamhill	1992	220	9480	2085	53.6
1118					
	1993	230	5600	1287	32.1
413					
	1994	250	7070	1767	36.3
641					
	1995	260	6800	1768	56.0
990					
Oregon	1992	3300	8790	29000	53.2
15414					
	1993	3450	5800	20000	32.5
6491					
	1994	3790	7070	26800	35.7
9575					
	1995	3850	6420	24715	56.1
13870					

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix table 13--Evergreen blackberry acreage, yield, and production in Oregon, selected counties, 1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	370	10,150	3,754	27.9	1,045
	1993	300	8,300	2,490	29.0	722
	1994	300	8,800	2,640	42.9	1,133
	1995	250	8,550	2,137	48.9	1,044
Marion	1992	700	9,700	6,790	27.4	1,859
	1993	660	8,230	5,434	28.6	1,552
	1994	650	8,720	5,669	41.8	2,371
	1995	590	8,550	5,046	48.9	2,465
Polk	1992	80	9,200	736	28.3	208
	1993	80	8,200	656	29.0	190
	1994	85	8,710	740	42.8	317
	1995	70	8,560	599	48.9	293
Washington	1992	100	11,000	1,100	28.9	318
	1993	80	9,000	720	30.0	216
	1994	80	8,750	700	41.9	293
	1995	70	8,560	599	48.9	293
Yamhill	1992	50	10,200	510	31.2	159

	1993	40	8,500	340	30.0
102					
	1994	40	8,750	350	46.9
164					
	1995	35	8,570	300	49.0
147					
Oregon	1992	1,400	9,860	13,800	28.0
3,870					
	1993	1,250	8,320	10,400	29.3
3,048					
	1994	1,250	8,720	10,900	42.6
4,647					
	1995	1,100	8,550	9,400	48.9
4,592					

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix table 14--Boysenberry acreage, yield, and production in Oregon, selected counties,
1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	180	6,200	1,116	65.2	728
	1993	180	4,510	811	74.2	602
	1994	220	5,040	1,108	63.0	698
	1995	220	3,950	870	78.4	682
Marion	1992	520	5,800	3,016	65.3	1970
	1993	510	4,420	2,255	74.8	1686
	1994	580	5,030	2,919	62.5	1824
	1995	580	3,960	2,296	78.3	1797
Multnomah	1992	70	6,100	427	65.1	278
	1993	70	4,500	315	80.0	252
	1994	70	5,030	352	66.8	235
	1995	70	3,960	277	80.5	223
Washington	1992	90	7,570	681	65.1	443
	1993	90	4,800	432	75.0	324
	1994	120	5,530	664	63.0	418
	1995	120	4,060	487	78.2	381
Yamhill	1992	100	7,000	700	65.0	455

	1993	100	5,000	500	75.2
376					
	1994	130	5,030	654	63.0
412					
	1995	130	3,960	515	78.3
403					
Oregon	1992	1000	6,150	6,150	65.5
4028					
	1993	1000	4,550	4,550	75.4
3429					
	1994	1200	5,080	6,100	63.2
3853					
	1995	1200	3,980	4,780	78.5
3750					

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix table 15--Loganberry acreage, yield, and production in Oregon, selected counties,
1992-95

County	Year	Harvested Area	Yield/ Acre	Production	Price	Value
		Acres	Lbs/acre	1,000 lbs	Cents/lb	$1,000
Clackamas	1992	40	6,200	248	50.0	124
	1993	30	5,200	156	36.5	135
	1994	30	4,670	140	84.3	118
	1995	25	4,000	100	85.0	85
Marion	1992	60	5,800	348	47.1	164
	1993	50	4,840	242	70.2	170
	1994	50	4,360	213	78.9	168
	1995	45	3,780	170	80.6	137
Multnomah	1992	10	6,400	64	57.8	37
	1993	10	5,200	52	98.1	51
	1994	10	4,700	47	91.5	43
	1995	10	4,000	40	100.0	40
Oregon	1992	110	6,000	660	49.2	325
	1993	90	5,000	450	79.1	356
	1994	90	4,440	400	82.3	329
	1995	80	3,880	310	84.5	262

Source: Oregon State University. Department of Agriculture and Resource Economics.

Appendix A

Selected Raspberry and Blackberry Cultivars Produced in the United States

(*Sources: Crandall; Funt and others; Goulart and others*.)

Red Raspberries

Amity: From Oregon. Primocane bearing, one to two weeks earlier than 'Heritage,' vigorous, moderate production, some root rot resistance. Fruit: Medium size, very firm, medium dark red, good for processing and fresh market.

Autumn Bliss: From Great Britain. Primocane bearing, erect, two to three weeks earlier and more productive than 'Heritage,' aphid resistant, root rot resistant. Fruit: Large, dark red, medium firm, mild flavor. Grown in Pacific Northwest. Recommended for the northeastern U.S. on a trial basis.

Boyne: From Manitoba. Summer bearing, early-midseason, hardy, vigorous, sturdy, good yield. Fruit: Medium size, dark red, aromatic, only fair flavor. Canes susceptible to *Verticillium* wilt. A new hardy cultivar for the Midwest and northern states.

Chilliwack: From British Columbia. High yields, upright canes, many primocanes, long strong laterals, hardy, aphid resistant. Fruit: Large, conic, glossy medium red, firm, very good flavor, easy to machine harvest, good for both fresh and processing markets. Promising new cultivar in Pacific Northwest.

Dorman Red: Grown in the South. Short chilling requirement. Fruit: Does not have the quality that the northern raspberries have, but is a raspberry adapted to the South.

Festival: From Ontario. Hardy, moderate yield, compact. Fruit: Medium size, firm, fair flavor. Newer, promising cultivar for the Midwest and northern United States. Recommended for trial only.

Heritage: From New York. Primocane bearing, vigorous, productive, upright, late season, widely adapted. Fruit: Medium size, attractive medium red, firm, fair flavor, good for freezing. Limited to warmer climates by its late ripening. Important primocane fruiting variety in the Pacific Northwest and California. Also widely grown in the Midwest and Northeast.

Hilton: From New York. Summer bearing, vigorous, productive, mid-season, upright, winter hardy. Fruit: Large, conic, dark red, firm good flavor. Newer variety in the Midwest and Northeast.

Killarney: From Canada. Summer bearing, hardy, sturdy canes. Fruit: deep red, firm, sweet, good quality. Newer variety being grown in the Midwest on a trial basis.

Red Raspberries, continued

Latham: From Minnesota. Summer bearing, very hardy, vigorous, medium yield. Fruit: Small, round, light red, fair flavor. Widely planted in the Midwest and Northeast.

Meeker: From Washington. Vigorous, productive, suitable for machine harvesting. Fruit: Large, medium red, firm, good quality, suitable for fresh and processing markets. Grown in the Pacific Northwest.

Nordic: From Minnesota. Summer bearing, hardy, vigorous, productive, produces a very late fall crop. Fruit: Medium size and color, firm, good flavor, suitable for processing. Recommended for the Midwest and Northeast on a trial basis.

Redwing: From Minnesota. Primocane bearing, hardy, very productive, ripens earlier than 'Heritage.' Fruit: Large, good flavor, tends to be soft. Newer variety for the Midwest and Northeast.

Ruby: From New York. Primocane bearing, slightly later than 'Heritage,' moderate yield. Fruit: Large, conic, bright medium red, good shelf life. Susceptible to root rot. Newer variety for the Midwest and Northeast.

Summit: From Oregon. Primocane bearing, vigorous, productive, very early, root rot resistant, good for both fresh and processing markets. Fruit: Medium size, round, medium red, firm. Grown in the Pacific Northwest.

Titan: From New York. Summer bearing, early, very productive, moderate vigor, not suited to machine harvesting. Fruit: Very large, bright red, good flavor, soft. Susceptible to viruses and root rot. For Midwest and Northeast.

Tulameen: From British Columbia. Primocane bearing, Very productive, long late season, vigorous, suitable for machine harvest, good for both fresh and processing markets, aphid resistant. Fruit: Very large, conic, bright, medium red, firm high quality.

Willamette: From Oregon. Vigorous, numerous primocanes, widely adapted, disease and pest resistant, suitable for machine harvest, will produce a fall crop in warm climates. Fruit: Large, conic, dark red, firm, excellent for processing, good flavor. Susceptible to root rot. Grown in the Pacific Northwest.

Black Raspberries

Allen: From New York. Vigorous, intermediate hardiness, medium yield, early, concentrated crop. Fruit: Large, firm, good quality. Susceptible to anthracnose. Recommended for the Midwest and Northeast.

Blackhawk: From Iowa. Vigorous, medium yields, hardy, late, resistant to anthracnose. Fruit: Large, firm, good quality. Recommended for the Midwest and Northeast.

Bristol: From New York. Very popular, productive, early. Fruit: Large, firm glossy black, medium size, good quality. Susceptible to anthracnose. Recommended for the Midwest and Northeast.

Cumberland: From Pennsylvania. Older cultivar, late, fair yield, midseason, susceptible to anthracnose, Lacks hardiness. Fruit: Large, firm, good quality. Recommended for the Midwest and Northeast.

Jewel: From New York. Early, productive, vigorous, hardy, resistant to anthracnose. Fruit: Large, firm, glossy, excellent flavor.

Munger: From New York. Principal Oregon cultivar, early, suitable for machine harvesting. Fruit: Medium size and yield, excellent for processing.

Blackberries

Arapaho: From Arkansas. Very erect, thornless, early, productive, suckers freely. Fruit: Good quality, firm, medium size, short conic, glossy black.

Black Satin: From Illinois. Semi-erect, thornless, very late, vigorous, productive. Fruit: large, firm, tart.

Boysenberry: From California. Trailing, late, very productive. Fruit: Large, soft, purple-black, tart with excellent flavor for processing. Best adapted to the South and Pacific Coast States.

Brazos: From Texas. Thorny, low chill, very early, vigorous, productive, spreading. Fruit: Very large, medium size, firm, glossy black, large seeds.

Cheyenne: From Arkansas. Erect, thorny, low chill, early, productive, resistant to orange rust. Fruit: Very large, firm, glossy black, excellent quality.

Chester: From Illinois. Semi-erect, thornless, late, vigorous, cold hardy, very productive, resistant to cane blight. Fruit: Large, very firm, excellent flavor, resists hot weather.

Darrow: From New York. Very erect, thorny, vigorous, hardy, early. Fruit: Medium size, firm, good flavor.

Hull Thornless: From U.S. Dept. of Agriculture. Semi-erect, thornless, very late, productive, very vigorous. Fruit: Large, firm, dull black, sweet.

Illini Hardy: From Illinois. Erect, thorny, late, vigorous, very cold hardy. Fruit: Medium size, glossy, good flavor.

Loganberry: Trailing, early maturing. Fruit: large, dark red, highly flavored, but acidic and used primarily for jams and jellies. Loganberry is not well adapted to the eastern U.S.

Marion: From Oregon. Trailing, thorny, early, productive. Fruit: Medium size, glossy black, excellent flavor. Adapted to the Pacific Northwest.

Navaho: From Arkansas. Erect, thornless, late, productive, suckers poorly. Medium size, very firm, glossy black, very good flavor.

Blackberries, continued

Olallieberry: From Oregon. Trailing, thorny, vigorous, midseason, very productive. Fruit: Large, firm, glossy black, good flavor. Adapted to California and western Oregon.

Rosborough: From Texas. Erect, thorny, early, very productive, low chill. Fruit: Very large, sweet, glossy black.

Shawnee: From Arkansas. Erect, thorny, very productive, late, Immune to orange rust. Fruit: Very large, medium firm, good flavor. Adapted to the southern United States.

Silvan: From Australia. Trailing, thornless, late, vigorous, very productive, machine harvestable. Fruit: Large, glossy purple-black, good flavor, sweet, suitable for both fresh and processing markets.

Thornless Evergreen: From Oregon. Trailing, thornless, late, vigorous, very productive, machine harvestable. Fruit: Large, glossy black, fair flavor. The most widely grown blackberry in the Pacific Northwest.

Waldo: From Oregon. Trailing, thornless, mid-early, high yield, machine harvestable. Fruit: Large, firm, glossy black, multipurpose, good shelf life.

Appendix B

Cost of Production Budgets

Santa Cruz County, California Raspberries
(Willamette and Heritage)

Willamette Valley Region, Oregon Red Raspberries
(Processing)

Michigan Red Raspberries
(Pick-Your-Own)

Oregon Marion Blackberries
(Every-year and Alternate-Year Production)

Figure 1. Major raspberry counties in California, Oregon, and Washington

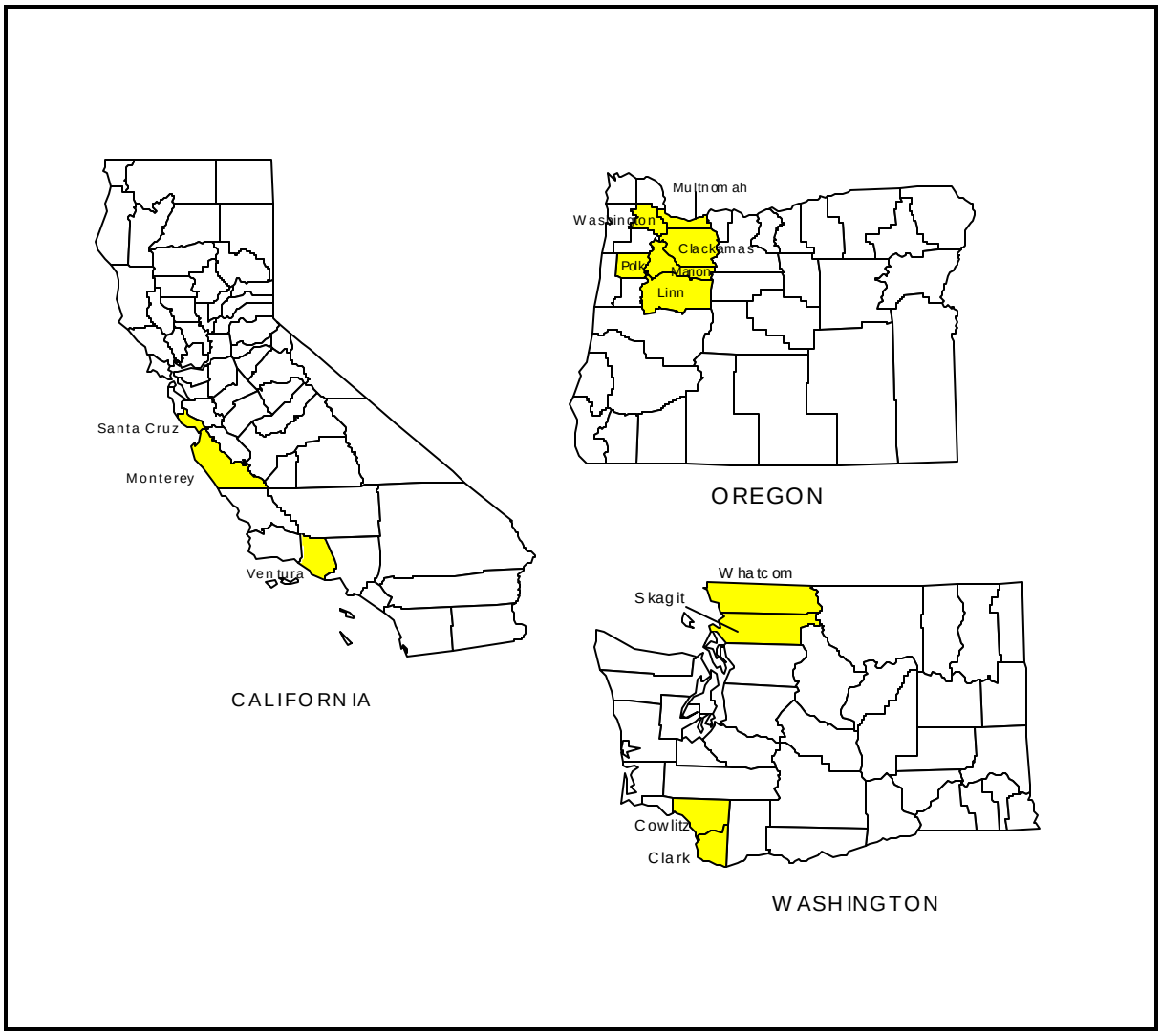
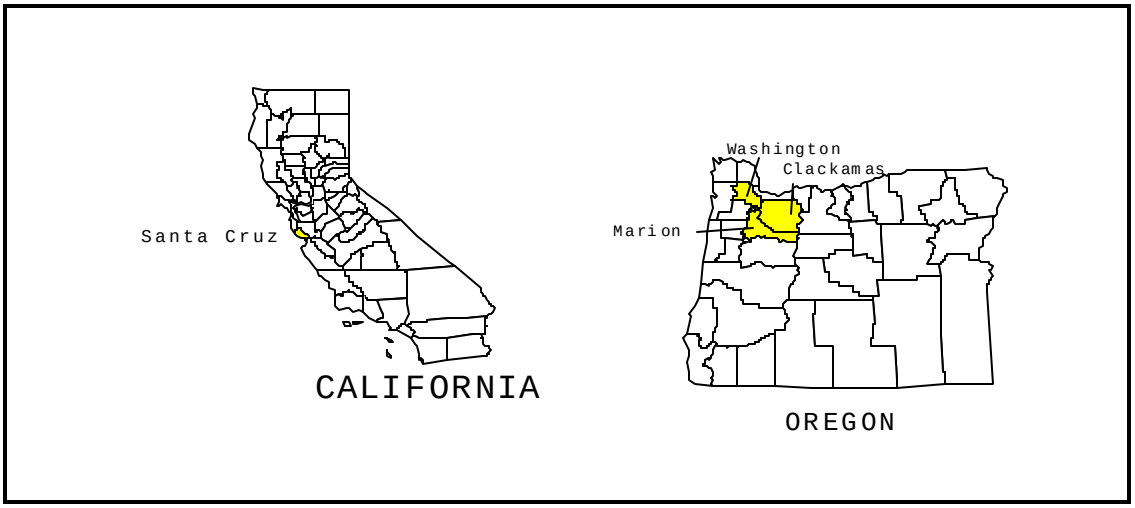


Figure 2. Major blackberry counties in California and Oregon



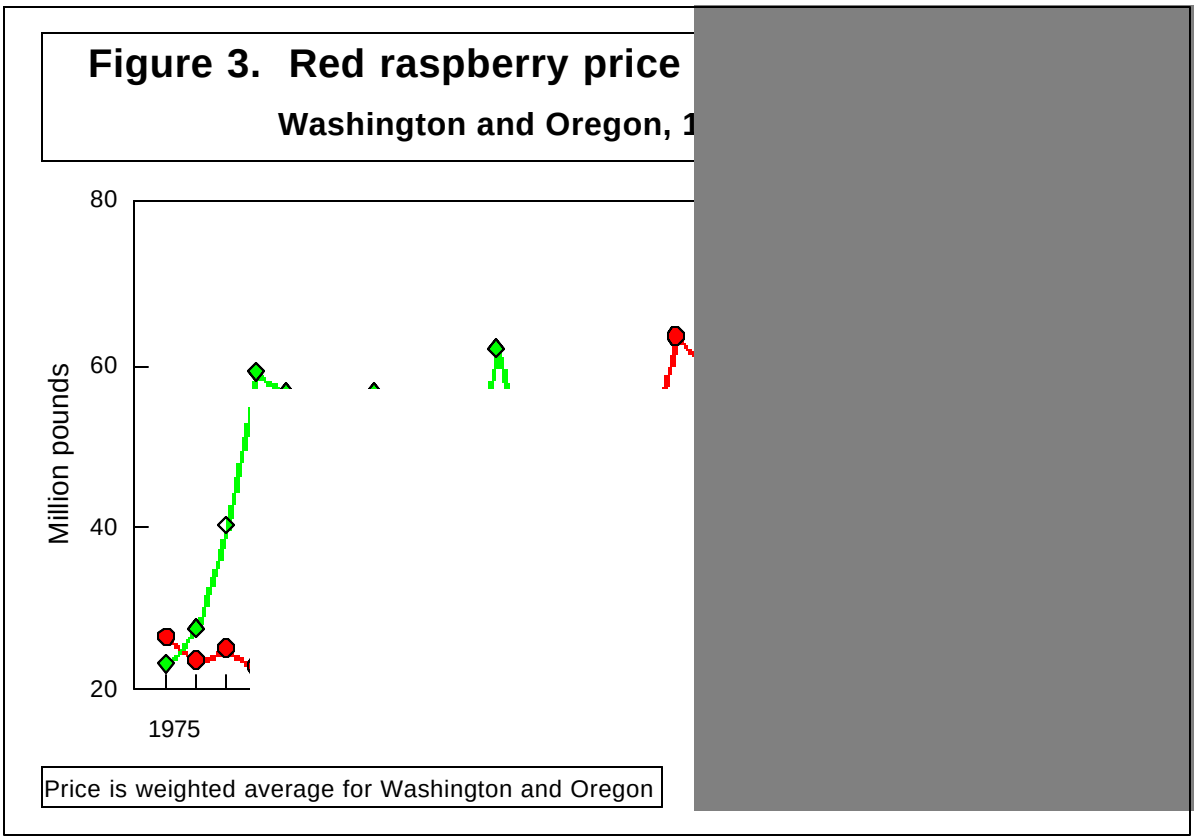


Figure 3. Red raspberry price
Washington and Oregon, 1
80
60
40
20
Million pounds
1975
Price is weighted average for Washington and Oregon

Raspberry and Blackberry Contacts

California

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