

**TRENDS IN PRODUCTION, UTILIZATION
and PRICE of
WASHINGTON APPLES TO 2005***

by

A. Desmond O'Rourke¹

**IMPACT Center
Information Series #94
June 1999**

*This report updates the information contained in prior forecasts - Information Series No's 58, 71, 86 and 90.

¹Dr. A. Desmond O'Rourke is Director of the IMPACT Center and Professor of Agricultural Economics, College of Agriculture and Home Economics, Washington State University, Pullman, Washington.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
LIST OF TABLES AND FIGURES	iv
INTRODUCTION	1
MAKING PROJECTIONS	2
PROJECTED ACREAGE	9
PROJECTED PRODUCTION	11
PROJECTED UTILIZATION OF AN AVERAGE CROP	13
PROJECTED FRESH PRICES FOR AN AVERAGE CROP	15
IMPLICATION OF FORECASTS	22
APPENDIX	24

EXECUTIVE SUMMARY

The Washington State apple industry experienced dramatic increases in new plantings between 1978 and 1982. This resulted in record apple crops and depressed prices in 1987 and 1989. Short world crops in 1990 and 1991 have encouraged a fresh surge of new plantings, many of varieties new to Washington State. However, until a census of the Washington State apple industry was taken in 1986, there was an inadequate basis for long-term planning of industry marketing strategy. A more recent census was completed in 1993. However, the Washington apple industry again had record crops in 1994, 1996 and 1998. Considerable experimentation with new varieties, rootstocks and tree densities has taken place since the 1993 census.

This report attempts to develop a long term forecast of future Washington apple industry production, utilization and price through the year 2005. While the best available data have been used, not all the factors likely to affect the future size of the Washington apple crop could be covered.

Best available estimates suggest that total Washington State apple acreage will continue to increase through the turn of the century. Because of increased acreage and denser plantings, production at average yields in the year 2000 could exceed 1995 production by over 14 percent and by over 20 percent in the year 2005. In years of high yield, total production could exceed 160 million boxes. Fresh pack could consistently exceed 100 million boxes.

Red Delicious and Golden Delicious will remain the top two varieties into the twenty-first century, but Fuji and Gala will leapfrog ahead of Granny Smith. Braeburn, Romes and Jonagold will achieve substantial production. Prices of the major varieties will remain under pressure (especially in years of above average yields), and will remain below those for the newer varieties for most of the 1990s. However, slated expansion of newer varieties could rapidly erase current price premiums.

LIST OF TABLES

Table 1.	Assumptions of Washington apple acreage	6
Table 2.	Assumptions on one-year old plantings in the period 1993-2005 (acres)	8
Table 3.	Acreage of Washington apples, 1993 Actual and 2000 and 2005 projected	10
Table 4.	Production of Washington apples, Actual 1995 and Projected 2000 and 2005, at average yields	12
Table 5.	Utilization of Washington apples, Actual 1995 and Projected 2000 and 2005, at average yields.	14
Table 6.	F.O.B. prices of Washington fresh apples, Actual 1995-96 and Projected 2000 and 2005, at average yields and 1998 prices.	16

LIST OF FIGURES

Figure 1.	Estimated Yield Curves for Washington Apples, 1993	4
Figure 2.	Gala: Actual and Forecast Fresh Shipments and FOB Price, 1990-2005	18
Figure 3.	Fuji: Actual and Forecast Fresh Shipments and FOB Price, 1991-2005	19
Figure 4.	Braeburn: Actual and Forecast Fresh Shipments and FOB Price, 1991-2005	20
Figure 5.	Jonagold: Actual and Forecast Fresh Shipments and FOB Price, 1991-2005	21

APPENDIX

Table 1.	FOB Price Prediction equations used in making forecasts	24
----------	---	----

INTRODUCTION

Washington State currently accounts for about half of total U.S. apple production and the majority of U.S. exports. Since 1977, large blocks of new plantings have been made in the state, many in irrigated areas not previously planted to fruit trees. Between 1977 and 1987, production of apples in Washington State doubled. It increased a further 50 percent in the 1988-1998 decade.

Very large crops in 1987 and 1989 depressed overall prices of Washington State apples. The prices of the major varieties, Red Delicious and Golden Delicious, were hit more severely than newer varieties such as Granny Smith and Gala. The fruit census of 1986 showed that the Washington apple industry was overwhelmingly dependent on Red Delicious and Golden Delicious which accounted for 75 percent and 14 percent respectively of total acreage. Many growers subsequently attempted to diversify into other varieties. The fruit census of 1993 showed that these attempts had been successful. By 1993, the acreage of Red Delicious had fallen to 64 percent and of Golden Delicious to 13.5 percent of the state total.

The expected future volume of Washington apple production, both total and by variety, remains of intense interest to Washington producers, packers and processors, and to their customers and competitors both in the United States and around the world.

This report attempts to provide conditional answers to how large the Washington apple crop will be by the year 2005, its varietal makeup, its use in fresh and processing markets, and its effect on prices. This information should assist the Washington apple industry in its long-term investment and marketing strategies.

MAKING PROJECTIONS

Making projections about the future shape of any industry is hazardous. Often, the exact data needed are not available. Unforeseen events such as war, energy shortages or new economic alliances can alter decisions. In the case of a perennial crop such as apples, the acreage base does not usually change rapidly unless a killing winter freeze occurs. On the other hand, the annual crop from a given acreage can vary widely as a result of spring frosts, pollination conditions, hail or other weather variables.

The three main factors involved in making projections of apple production are: (1) an inventory of the trees in each age group in some initial year (in this case 1993, the year of the latest tree census); (2) a yield curve of annual expected production per acre for trees in each age group; and (3) estimates of trees planted and trees removed from each age group in each year, so the inventory of trees in each subsequent year can be calculated.

The 1986 and 1993 Washington Fruit Surveys were used as a basis for developing the initial inventory of trees in each age group. The 1986 survey reported total acreage on January 1, 1986 of five varieties, Red Delicious, Golden Delicious, Granny Smith, Rome Beauty and Winesap. For Red Delicious, acreage planted was reported for each year between 1974 and 1985 and for longer intervals prior to 1974. Estimates of annual plantings prior to 1974 were based on unpublished information on plantings and removals provided by the Washington Crop and Livestock Reporting Service. For Golden Delicious and Granny Smith varieties, estimates of annual plantings were based on the acreage reported for "Other Apples" in the 1986 Washington Fruit Survey. The 1993 Fruit Acreage Survey reported annual plantings by variety from 1981 on for Red Delicious, Golden Delicious, Granny Smith, Gala, Fuji and Braeburn apples. Estimates of annual plantings for Rome

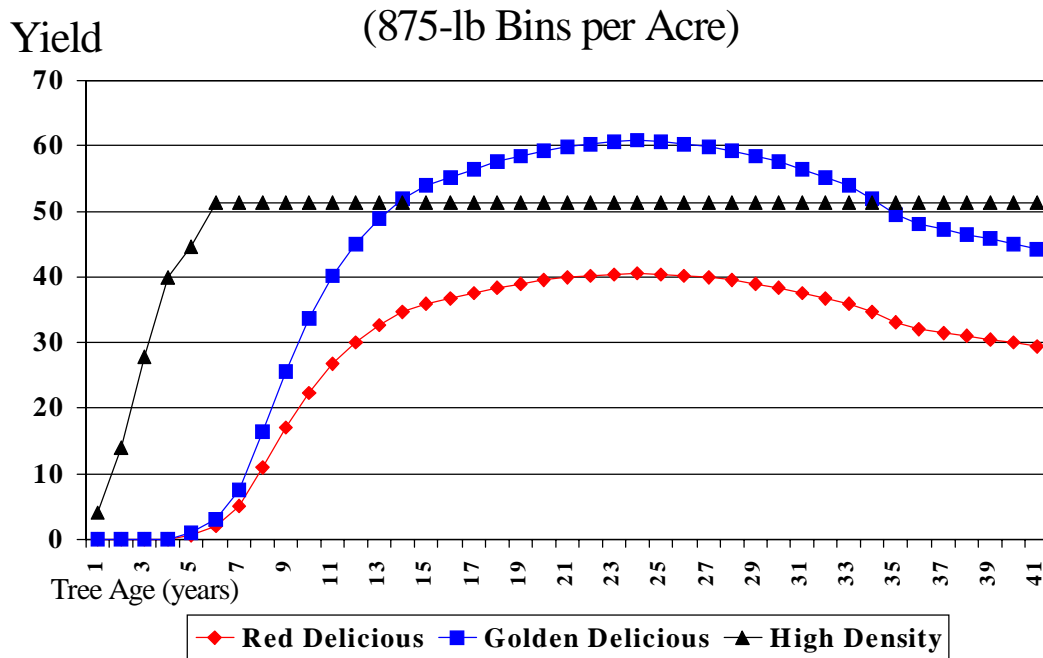
and Jonagold and all other apples were based on the occasional nursery sales estimates of Treetop executives Bob Dennis and Lindsay Buckner.

Few recent estimates of yield curves exist for any of the major apple varieties grown in Washington. Yield can be affected among other things by rootstock, tree density, support systems and cultural practices. The yield data discussed in press reports and at annual meetings of the Washington State Horticultural Association is fragmentary and anecdotal. For simplicity, we assumed a separate yield curve for low-to-medium density plantings of Red Delicious, for Golden Delicious and for high density plantings (Figure 1). We assumed that Rome had the same yield curve as Red Delicious. Golden Delicious was assumed to have a yield curve 50% higher for each age group than Red Delicious. Since the other variety category included both old varieties like Winesap and newer varieties like Pink Lady, an average of Red Delicious and high density yields was used for the other category.

It was assumed that Granny Smith, Gala, Jonagold, Fuji and Braeburn were all high density. While this is not true in all cases, it is hoped that this assumption does not distort production estimates unduly. In general, the high density plantings begin commercial production earlier and produce higher yield at each age. For high density plantings, we used the yield curve reported by Geldart as discussed in *Intensive Orchardling*, edited by A. Brooke Peterson. However, many growers have experienced difficulty in getting rapid production with unfamiliar varieties.

The inventory of trees changes from year to year either through removals or new plantings. Trees can be lost at any age due to disease, or damage from wind, animals, equipment or other sources. Trees can be removed because of old age, loss of productivity or other economic reasons. Historically, the percentage of Washington apple trees lost or removed in any year has been small. We assumed a survival rate of trees from one year to the next ranging from 99% of one-year old trees to 95% of forty-one-year old trees.

Figure 1. Estimated Yield Curves for Washington Apples, 1993



Source: Author's Estimates

For trees already planted, we assumed that 99% of the one-year old trees would survive to be two-year-old the next year (Table 1). Of the two-year-old trees, 98.9% would survive to be three-year-old trees the following year, and so on. Thus, we can project how many acres of a variety planted in any year will still be producing fruit for each of the next 40 years. Our assumption implies a 14% tree loss in the first 10 years, a further 22% loss of the survivors in the next decade, 30% in the third decade, and 37% in the fourth decade. These survival rates may be high for recent plantings where investors envisage a much shorter useful life for their orchard. A comparison of the 1993 and 1986 Fruit Acreage Surveys suggests that some newer blocks have been pulled in recent years, reducing the average survival rate.

It is more difficult to estimate how many acres of each variety will be planted in each future year. For the established varieties such as Red Delicious, Golden Delicious and Granny Smith we assumed that most new plantings would simply be replacements, at 2% of the standing acreage. For newer varieties such as Fuji, new plantings will clearly respond to price experience over time. For these, we assumed a level of new plantings that appeared reasonable given current trends (Table 2). However, these projections are sensitive to future changes in industry attitudes as growers and packers learn more about the idiosyncracies of each variety under Washington conditions. Growers have shown that they are able to change plans quickly as new information becomes available on each variety.

In comparison to previous editions of this report, readers will note a sharp reduction in the expected new plantings of Fuji, Braeburn and Rome varieties. New plantings of Granny Smith are expected to be higher, and there is a 14 percent increase in expected new plantings of miscellaneous varieties such as Cameo and Pink Lady.

Table 1. Assumptions of Washington apple acreage, average annual yield and percent survival to the next year.

Tree Age	Yield ¹ (875 lb. bins)	Percent Surviving to Next Year	1991 Acres
1	1.3	99.0	3651
2	2.6	98.9	3820
3	3.2	98.8	3196
4	5.0	98.7	4391
5	6.4	98.6	3819
6	8.0	98.5	4147
7	9.8	98.4	3297
8	15.0	98.3	5825
9	20.5	98.2	9203
10	26.4	98.1	10341
11	29.4	98.0	12506
12	33.7	97.9	9926
13	36.9	97.8	7209
14	36.8	97.7	3507
15	37.8	97.6	5292
16	38.8	97.5	4993
17	39.9	97.4	3240
18	40.1	97.3	1524
19	40.8	97.2	3601
20	40.3	97.1	3996
21	43.4	97.0	9548
22	43.7	96.9	7671

¹Weighted average yield from high density and low density plantings. See discussion in text and Figure 1.

Table 1: Continued

Tree Age	Yield ¹ (875 lb bins)	Percent Surviving to Next Year	1991 Acres
23	43.9	96.8	4790
24	45.6	96.7	4523
25	45.5	96.6	1672
26	45.3	96.5	1663
27	45.0	96.4	1349
28	44.5	96.3	4674
29	44.3	96.2	1550
30	44.0	96.1	1337
31	43.1	96.0	1797
32	42.1	95.9	2062
33	41.2	95.8	1880
34	39.6	95.7	1700
35	38.5	95.6	1622
36	36.7	95.5	1345
37	36.1	95.4	1184
38	34.6	95.3	1080
39	34.5	95.2	976
40	34.4	95.1	874
41	34.3	95.0	773

¹Weighted average yield from high density and low density plantings. See discussion in text and Figure 1.

Table 2. Assumptions on one-year old plantings in the period 1993-2005 (acres).¹

YEAR	GRANNY SMITH	GALA	FUJI	BRAEBURN	ROME	JONAGOLD	OTHER
1993	242	452	1,222	491	356	319	411
1994	278	681	1,440	299	191	262	498
1995	182	963	1,464	167	68	168	1169
1996	496	1,343	918	150	46	202	1318
1997	589	1,317	506	141	45	127	874
1998	959	1,542	337	85	45	75	814
1999	1139	1,409	328	70	65	119	1,346
2000	863	1,360	486	101	68	95	1,302
2001	600	1,200	400	100	50	100	1,000
2002	600	1,150	400	100	50	100	1,000
2003	600	1,100	400	100	50	100	1,000
2004	600	1,050	400	100	50	100	1,000
2005	600	1,000	400	100	50	100	1,000
TOTAL	7,748	14,567	8,701	2,004	1,134	1,867	12,732

¹ 1991-93 Plantings of Granny Smith, Gala, Fuji and Braeburn are reported in the 1993 Washington Fruit Survey.

1991-93 Plantings of Rome and Jonagold are derived from the Dennis-Buckner nursery surveys.

1994-2000 Plantings of all varieties are derived from the Dennis-Buckner nursery surveys.

1997-2005 Plantings of all varieties forecast by author.

PROJECTED ACREAGE

Using the forgoing assumptions, it was possible to estimate future acreage and production for all Washington apples and for all major individual varieties through the year 2005. By that time, Washington apple acreage could exceed 185,000 acres, 10 percent above 1993 Census levels.

In general, we anticipate a slow shrinkage of Red Delicious acreage from 121,175 in 1986 to 95,854 in 2005 (Table 3). Thus, by 2005, we anticipate that Red Delicious will account for 52% of Washington state apple acreage, compared to over 75% in 1986. Golden Delicious acreage is expected to decline gently and to reach 20,865 acres, 11.3% of Washington apple acreage, in 2005. Expansion of Granny Smith acreage has recovered in the late 1990s, as acreage has been removed in California. By 2005, acreage should reach 13,458 acres, 7.3 percent of the total.

Based on the 1993 Fruit Acreage Survey, combined acreage of Gala, Fuji, Braeburn and Jonagold could reach 32,500 acres by 2000 and 38,000 acres by the year 2005. However, unforeseen production or price problems could lead to serious errors in that projection. Other varieties not now prominent are expected to increase during the 1990s. By the year 2005, close to 25 percent of Washington state apple acreage could be planted to varieties that were not commercially available in 1986.

Table 3. Acreage of Washington apples. 1993 actual and 2000 and 2005 projected.

Variety	Actual	Projected Acres	
	<u>1993</u>	<u>2000</u>	<u>2005</u>
Red Delicious	110,000	103,888	95,854
Golden Delicious	23,300	21,899	20,865
Granny Smith	8,500	11,817	13,458
Gala	5,900	13,582	17,813
Fuji	11,100	13,883	14,569
Braeburn	3,300	3,216	3,409
Rome	6,140 ¹	4,084	3,694
Jonagold	1,200 ¹	1,800	2,136
All Other	2,560	9,609	13,629
TOTAL	172,000	183,778	185,427

Sources: Actual 1993. Washington Agricultural Statistics Service. 1993 Washington Fruit Survey, 1993, Olympia, Washington.

Projected 2000-2005: Author's estimates. See text.

¹Author's estimate

PROJECTED PRODUCTION

Using the projections of acreage of each variety at each age in each future year and multiplying by expected average yield gives us expected average production of each variety in each year. The actual production in the crop year 1995 is compared with the projected production in 2000 and 2005 (Table 4). For reasons discussed earlier, some acreage may not be included in these projections.

It should be noted that the projected production for any year (say 2000) represents the volume that would be expected on average for a number of years around that period. A number of factors such as weather or alternate bearing can cause production from a given acreage to vary up or down in any single season.

These estimates suggest that at expected average yields, the Washington apple industry could produce 14.4 percent more apples in the year 2000 and 20.4 percent more in 2005 than it did in 1990. However, the mix of varieties produced could change dramatically. Red Delicious would remain the dominant variety into the twenty-first century unless a major tree removal program is initiated. Golden Delicious production would be expected to decline in a similar manner. If Granny Smith acreage recovers as projected, production would be expected to increase by the turn of the century. Production of the newer varieties, Gala and Fuji, would increase dramatically while Jonagold and Braeburn would increase rapidly. Production of other traditional varieties would decline, with the exception of Rome which have been making a modest comeback.

The share held by Red Delicious could fall to about 50 percent in the year 2000 and below 45 percent by 2005. Golden Delicious share could fall to 14.9 percent in 2000 and 13.0 percent in 2005. Granny Smith share could rise to 7.2 percent in 2000 and 8.8 percent in 2005. The share of the four newer

bicolored varieties, Gala, Fuji, Jonagold and Braeburn, which was less than one percent in 1990, could exceed 22 percent in 2000 and 26 percent in 2005. This has major implications for the pricing and promotion of all Washington apples.

Table 4. Production of Washington apples, Actual 1995, and Projected 2000 and 2005 at average yields¹

Variety	Actual		Projected	
	1995	2000	2005	
(Thousand 42-lb box equivalent)				
Red Delicious	69,214	67,000	62,300	
Golden Delicious	23,355	19,700	18,000	
Granny Smith	8,250	9,500	12,200	
Gala	4,526	10,900	16,300	
Fuji	5,376	13,700	14,500	
Braeburn	1,471	3,200	3,400	
Rome	1,290	2,200	2,500	
Jonagold	952	1,600	2,000	
All Other	1,042	4,300 ¹	7,800 ¹	
TOTAL	115,476	132,100	139,000	

¹Author's estimate. Note that these production forecasts assume average yields. Yields that are up to 20 percent above average or up to 20 percent below average occur quite frequently. Thus, actual production in 2005 could lie anywhere in the range from 111,200 to 166,800 thousand 42-lb. box equivalents.

PROJECTED UTILIZATION OF AN AVERAGE CROP

A key factor affecting the price received for the Washington apple crop is how the product is allocated to fresh and processing markets. On the basis of historical allocations, we estimated how much of the crop of each variety would be packed fresh and how much would go to all processing uses (Table 5). These historical allocations could change for newer varieties. As production expands and finding markets becomes more difficult, quality control standards for fresh pack will become more strict.

By the year 2000, total Washington fresh packs of 100 million boxes will become the norm. That level was almost reached in 1998. Fresh pack of Red Delicious would exceed the 1990 level throughout most of the 1990s but decline sharply after the year 2000. Golden Delicious would show a similar decline as existing plantings age. However, in the case of Granny Smith, a resurgence of plantings in the late 1990s will boost fresh pack near the 9 million box level by 2005.

Fuji could exceed 10 million fresh pack boxes and Gala 12 million by 2005. Braeburn should come close to 2.5 million and Jonagold 1.5 million.

Similar trends would occur for processing uses. By the year 2005, less than 45 percent of processed supplies would continue to be Red Delicious and less than 13 percent Golden Delicious. Other varieties would become increasingly important after 1995. The increasing diversity of processed apples available will provide new challenges and opportunities for state processors.

Table 5. Utilization of Washington apples, Actual 1995 and Projected 2000 and 2005 at average yields.¹

Variety	Actual		Projected	
	1995	2000	2005	
FRESH PACK (1000 42 lb boxes)				
Red Delicious	48,436	50,304	46,763	
Golden Delicious	15,570	14,774	13,505	
Granny Smith	5,499	7,128	9,160	
Gala	3,016	8,166	12,241	
Fuji	3,415	10,298	10,919	
Braeburn	982	2,397	2,543	
Rome	859	1,680	1,884	
Jonagold	552	1,237	1,520	
All Other	661	3,238	5,844	
TOTAL	78,990	99,221	104,379	
ALL PROCESSING (Tons)				
Red Delicious	436,350	352,127	327,341	
Golden Delicious	163,500	103,419	94,536	
Granny Smith	57,750	49,894	64,120	
Gala	31,700	57,161	85,686	
Fuji	41,200	72,089	76,433	
Braeburn	10,300	16,780	17,800	
Rome	9,050	11,758	13,186	
Jonagold	8,400	8,657	10,640	
All Other	7,950	22,664	40,909	
TOTAL	766,200	694,550	730,651	

¹Author's estimate. See also footnote to Table 4.

PROJECTED FRESH PRICES FOR AN AVERAGE CROP

Once we have an estimate of the Washington fresh pack in any year, we can estimate the expected price for that pack. However, since Washington apple prices are also affected by changes in U.S. per capita income, U.S. population, and supplies of other U.S. apples, it was necessary to make assumptions about changes in these variables. We assumed a U.S. population of 275 million in 2000 and 287 million in 2005. We assumed that U.S. per capita income would increase by 2 percent per year in real terms, close to the recent historical averages. We assumed that per capita supplies of all other U.S. fresh apples would be 5 percent above the level of 1995 in the year 2000 and 10 percent in 2005.

Based on these assumptions, the efforts of the Washington apple industry to market an average crop would lead to a price close to that reached in 1995-96 in the years of 2000 and 2005. (Table 6). This relatively stable picture for all fresh apples would conceal divergent trends among the major varieties. The prices of Red Delicious and Golden Delicious are expected to recover as production falls in the late 1990s. The price of Granny Smith will drift downwards as supply increases. Prices of the newer varieties, Gala, Fuji, Jonagold and Braeburn, are likely to fall sharply during the late 1990s as production increases. As demand data for these varieties accumulates, it becomes increasingly clear that the presently forecast levels of future production will drive prices below production costs. Clearly, growers will have to take remedial measures such as funding major market promotional programs or uprooting trees rather than continuing to produce apples at a loss.

Table 6. F.O.B. prices of Washington fresh apples, Actual 1995-96 and Projected 1995 and 2000 at average yields and 1998 prices.

Variety	Actual	Projected (1998 prices)	
	1995-1996 ¹	2000	2005
	\$/42 lb box		
Red Delicious	14.92	15.69	15.71
Golden Delicious	15.45	16.22	17.12
Granny Smith	18.47	16.48	13.21
Gala	25.29	12.50	8.50
Fuji	29.53	12.00	11.00
Braeburn	21.09	12.25	11.50
Rome	15.92	11.28	13.31
Jonagold	20.50	14.00	12.25
All Varieties	16.22	13.09	12.96

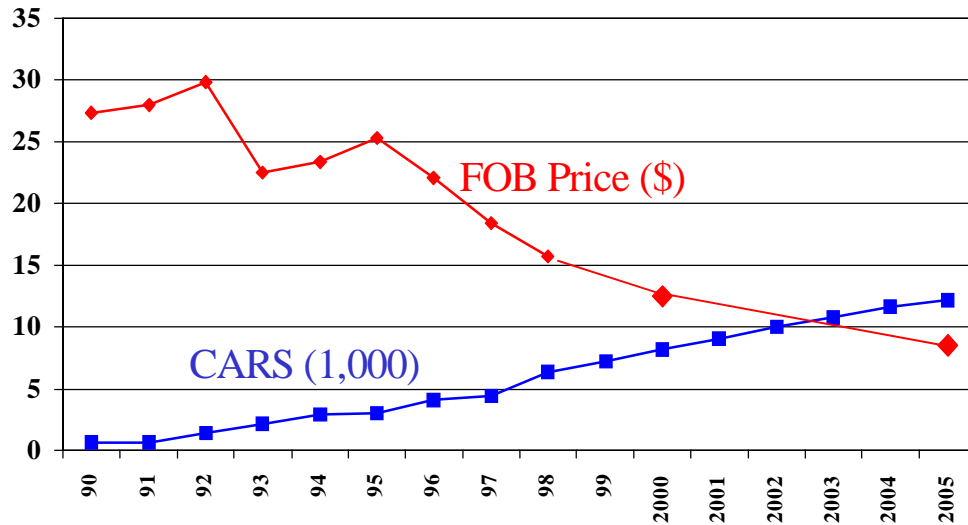
Source: Using the assumptions described in the text, these prices are derived from the price prediction equations reported in Appendix Table 1.

¹ Washington Growers Clearing House Bulletin Apple Price Summary, 1995-96 season

These figures show dramatically how prices will be impacted if supplies increase as forecast and demand for these newer varieties is not somehow expanded. Prices would not, of course, fall close to zero before growers would take action by pulling trees.

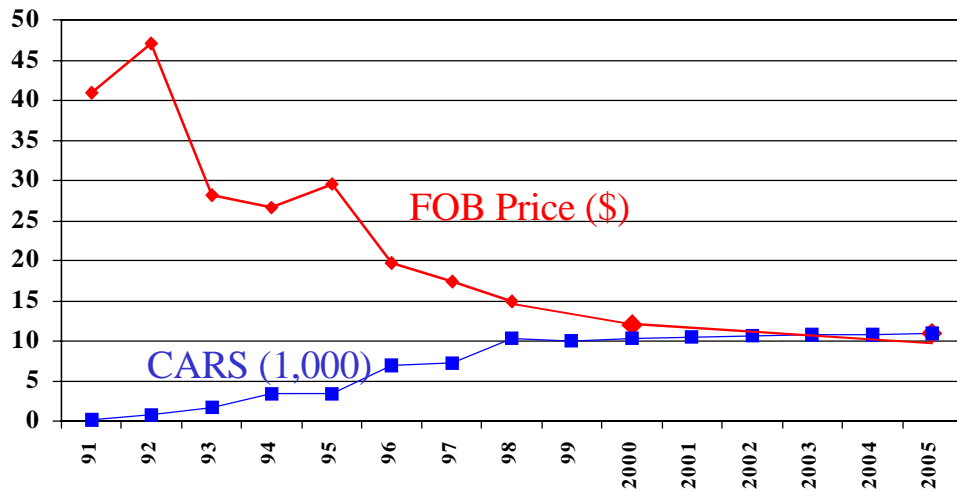
It should also be noted that these forecast prices reflect average yields. Actual yields in any year could vary by plus or minus 20 percent on any variety. This would affect average prices in the opposite direction.

Figure 2. Gala: Actual and Forecast Fresh Shipments and FOB Price, 1990 - 2005



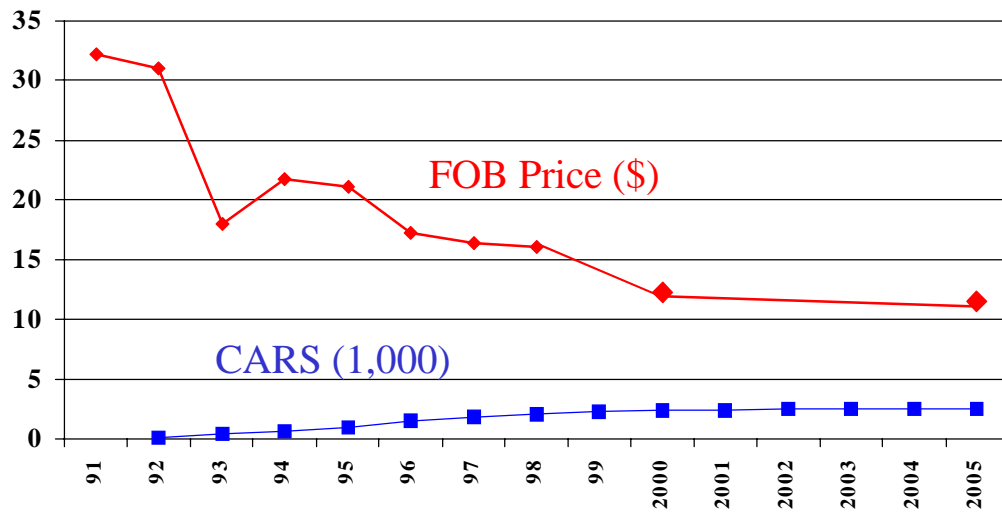
*Figures for 1999 - 2005 are forecast

Figure 3. Fuji: Actual and Forecast Fresh Shipments and FOB Price, 1991 - 2005



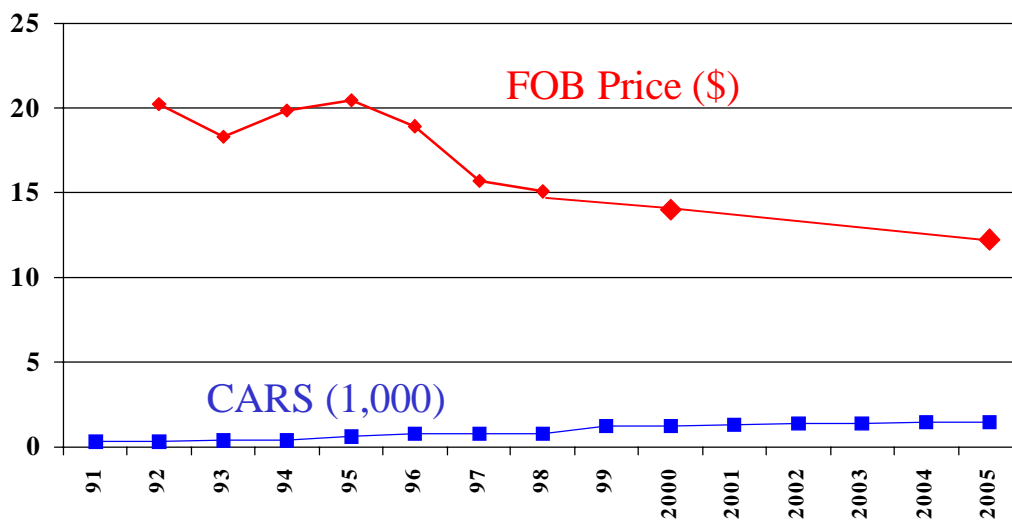
*Figures for 1999 - 2005 are forecast

Figure 4. Braeburn: Actual and Forecast Fresh Shipments and FOB Price, 1991 - 2005



*Figures for 1999 - 2005 are forecast

Figure 5. Jonagold: Actual and Forecast Fresh Shipments and FOB Price, 1991 - 2005



*Figures for 1999 - 2005 are forecast

IMPLICATION OF FORECASTS

The first implication which needs repeating is that the quality of any forecast is affected by the uncertainties of the future. The quality of these specific forecasts is influenced by the many assumptions that have had to be made to develop them. All of the assumptions could be improved if better data were available. Two pieces of data are particularly critical; an updated census of acreage by variety and age group, and accurate estimates of yield curves, particularly for the newer high density planting systems. The 1993 Washington Fruit Survey of acreage planted is rapidly becoming outdated and accurate yield curves are still a problem.

The major conclusion of the forecast is that the fortunes of the major varieties and their growers is likely to shift in the 1990s. The reduction of Red Delicious acreage and the stability of acreage of Golden Delicious and Granny Smith apples should bring improving price trends to these varieties in the 1990s. In contrast, price prospects for Gala, Fuji, Jonagold and Braeburn are less promising since production has expanded dramatically faster than anticipated. Even at average yields, the current and projected acreage of these newer varieties will lead to very severe downward price pressure. In seasons of above average yields, that pressure will be even more intense. In addition, we have no information on the possible effect on these prices of increased supplies of Gala, Fuji, Jonagold or Braeburn from other regions in the U.S., Europe, New Zealand or South America which are also growing rapidly. Nor did the data exist to estimate the interaction of prices between these varieties, for example, the effect on Gala price of increased supplies of Fuji, or vice versa.

Clearly, the Washington state apple industry will need strategies to effectively harvest, handle and market crops even larger and more varied than the record crops of 1987, 1989, 1996 and 1998. The industry will need to refine the programs that have been developed to harvest and segregate fruit for

different regional and seasonal markets. Control of size, appearance and internal quality will become even more critical. There will be new demands for improved storage technology, particularly for the newer varieties, as production grows and their marketing season lengthens. There will be a continued need to open and expand markets both domestically and in export.

The crises and controversies of the recent past are likely to reoccur in years of above average yield during the first decade of the twenty-first century when the industry will be called upon to handle record volumes of fruit. Now is the time to put in place adequate programs to meet the predictable problems of a growing industry.

Appendix Table 1. FOB Price Prediction Equations used in Making Forecasts ¹						
Variety	Constant	Own Quantity per capita	Substitute Q_1 per capita	Substitute Q_2 per capita	Income	R ²
All	59.183 (1.444)	-2.084 (1.659)	-1.346 Other U.S. (0.908)		- 0.0003 1 (0.244)	.55
Red Delicious	52.637 (0.659)	-0.630 (0.400)	+0.598 Other U.S. (0.382)		- 0.0016 5 (0.581)	.54
Golden Delicious	87.832 (2.699)	-3.018 (1.062)	-1.103 WA Reds (1.150)		- 0.0025 3 (1.861)	.51
Granny Smith	19.957 (2.292)	-11.830 (2.685)	+0.898 Non-Granny ² (1.309)			.56
Gala	- 220.79 9 (1.653)	-25.275 (1.440)	+7.684 Other New ³ (1.020)	+0.743 Non-New ⁴ (0.741)	+0.012 (1.939)	.92
Fuji	- 12.220 (0.031)	-1.430 (0.474)	-1.430 Non-Fuji ² (0.474)		+0.0038 7 (0.209)	.83
Braeburn	- 133.06 9 (0.460)	-94.165 (1.259)	-1.894 Non-Braeburn ² (1.115)		+0.0093 0 (0.654)	.77
Rome	- 13.456 (0.454)	-44.341 (2.136)	+1.002 Red Price (4.734)		+0.001 (0.856)	.91
Jonagold	28.568 (0.214)	-59.136 (0.508)	-0.038 Non-Jonagold ² (0.041)		+9.17 (E-06) (0.001)	.52

Footnote: 1. T-values in parentheses
2. All Washington less the quantity of the specific variety.
3. New Varieties are Gala, Fuji, Braeburn and Jonagold
4. Non-New equals All Washington less new varieties