A BRIEF LOOK AT THE WASHINGTON APPLE INDUSTRY: PAST AND PRESENT

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INTRODUCTION

The first apple tree in Washington is commonly believed to have been planted by a Hudson Bay employee at Fort Vancouver in 1826[4]. Over time more trees were planted by the missionaries and by settlers. However, commercial production did not begin until the late 1800's. Production in north central Washington and in the Yakima valley began as irrigation water became available. The first commercial orchards are believed to have been planted in the 1890's. Most of the orchards planted prior to that time were in western Washington and in southeastern Washington, near the population centers of the time. While not widely known, Whitman County was the leading producer of apples in Washington in1900.

Because of the sparseness of the population, growers soon began looking beyond the region for markets in which to sell their fruit. The completion of the railroads provided access to the major markets in the Midwest and the East. Historical records indicate that by the early 1920's Washington was the leading commercial producer of apples in the U.S.[5] Apples were shipped to all major markets in the U.S. as well as exported. By the late 1920's Washington was the no.1 or no. 2 supplier in each of the largest markets.

By the late 1920's Washington was the leading producer of apples. The favorable climate and the completion of irrigation canals in the Yakima valley and in north central Washington resulted in the rapid expansion of apple acreage, pushing Washington to the top of the list of producing states.

It was during this time that Delicious apples were extensively planted in Washington. This variety is the precursor of the variety we know as Red Delicious. Early returns for Delicious were better than any other variety and this induced many growers to plant this variety. Golden Delicious became popular a bit later. By the 1940's the 4 most important varieties in Washington were Red Delicious, Golden Delicious, Rome Beauty

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[4] Luce, W.A. "Washington State Fruit Industry; A Brief History." Published by Good Fruit Grower, Inc. Yakima WA. nd
[5] USDA, Bureau of Agricultural Economics. "Statistics and Charts of the Apple Industry". Washington, D.C. Mar. 1930.

and Winesaps. The latter two varieties continue to be grown in Washington, but the volumes are small and declining.

During the course of the first half of the 20th century the center of production shifted from the extreme eastern counties (primarily Whitman and Spokane) to Yakima, Chelan, Okanogan, and Douglas counties.[6]

In addition to the shift in the location of production, acreage likely declined. The early reports on the industry provided only tree number data. However, the over 50% decline in the number of bearing trees between 1920 and 1950 almost certainly reflects a significant decrease in acreage. Previously unpublished data now available from the Washington Agricultural Statistics Service (WASS) at http://www.nass.usda.gov/wa/hist/apples.pdf indicate a total of 132,000 bearing acres in 1919. From that time the industry lost acreage until the mid 1950's when bearing acreage was reported to be 53,300.

By 1961 tree numbers were again on the increase, having gone up some 64% in the intervening years.[7] That survey identified about 5.2 million trees in the major growing areas. Again, no acreage data were provided, however, the 1969 Census of Agriculture reported 85,000 acres of apples. The last fruit tree survey (2001) reported 75 million trees. The tremendous increase in numbers is due to many more acres and many more trees per acre.

The 1961 tree census used a figure of 100 trees per acre in making some production projections from the tree data. The 2001 survey reported an average density of 391 trees per acre.[8] Even this figure is misleading as the density of new plantings is about 600 trees per acre. Further, it is not uncommon to find blocks with densities of 1000 trees per acre or more.

The more recent fruit tree surveys and the Census of Agriculture now report acres as well as tree numbers. The most recent official estimate contained in the 2001 survey indicated about 192,000 acres. Since that time a significant number of acres have been removed. Table 1 shows the most current information. The reduction in acreage was identified by the Yakima Valley Grower-Shippers Association and the Wenatchee Valley Traffic Association. These data do not reflect any new plantings since the last WASS survey. Discussions with Nursery personnel suggest that some new trees have been planted since the survey that have not been counted. It is not possible to accurately estimate acreage by variety beyond the numbers reported in Table 1 as a significant number of acres have been planted with trees grown in private nurseries.

The latest agricultural census, conducted for 2002, identified 172,810 acres of apples.[9] Information was not collected on varieties.

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[6] USDA. Washington Crop and Livestock Reporting Service. Washington Tree Fruits. Seattle, WA. Dec. 1952.
[7] Washington Agricultural Experiment Stations. Institute of Agricultural Sciences. Washington Fruit Tree Census. Circular 441. Pullman, WA. October, 1964.
[8] USDA. WASS. Washington Fruit Survey, 2001. Olympia, WA. nd.
[9] USDA WASS. 2002 Agricultural Census. Olympia, WA, June 2004.

Table 1: - Acreage in Washington.

	2001 Fruit Survey*	2003 Estimate
Reds	82,000	66,709
Goldens	27,000	25,324
Granny Smith	17,600	16,669
Fuji	24,400	22,537
Gala	25,500	23,775
Other	15,500	13,227
Total	**192,000**	**168,241**

*Washington Agricultural Statistics Service

Source: Industry sources provided acreage removed data.

The geographic shifts mentioned above are particularly important to the apple industry and the communities that have grown up with the industry. There continue to be shifts in the location of production. The Columbia Basin is becoming more important in the industry as producers search for opportunities to increase size of operation and achieve some of the economies of size that are expected to occur. Table 2 contains acreage data by county from two censi of agriculture. The data show how Grant County has become very important. In recent years more acreage has been planted in the southern basin and Walla Walla County. Most of the fruit grown in these areas are shipped to the Yakima valley and to Wenatchee for storage and packing. Very few apple packing facilities exist in the southern part of the Columbia Basin.

Table 2: Acreage and number of orchards by county, 1992, 1997, and 2002.

	1992			1997			2002		
	NO.	**ACRES**	**AVE.**	**NO.**	**ACRES**	**AVE.**	**NO.**	**ACRES**	**AVE.**
ADAMS	28	2247	80.3	43	3457	80.4	42	3524	83.9
BENTON	211	10746	50.9	218	18425	84.5	214	13118	61.3
CHELAN	826	17825	21.6	690	17096	24.8	558	14195	25.4
DOUGLAS	411	14126	34.4	353	14383	40.7	284	12490	44.0
FRANKLIN	121	5347	44.2	161	9000	55.9	151	9093	60.2
GRANT	243	24154	99.4	318	33615	105.7	287	36480	127.1
KITTITAS	42	1095	26.1	39	1859	47.7	34	495	14.6
KLICKITAT	22	305	13.9	27	516	19.1	33	1171	35.5
OKANOGAN	631	25395	40.2	503	24164	48.0	448	17752	39.6
SPOKANE	63	453	7.2	44	227	5.2	74	574	7.8
WALLA WALLA	23	4042	175.7	22	5222	237.4	31	8489	273.8
YAKIMA	1454	61910	42.6	1334	75264	56.4	1100	54036	49.1
OTHER	521	1462	2.8	455	1446	3.2	614	1393	2.3
TOTAL	**4596**	**169107**	**36.8**	**4207**	**204674**	**48.7**	**3870**	**172810**	**44.7**
2002 ESTIMATE FOR 1997				4910	215463	43.9			

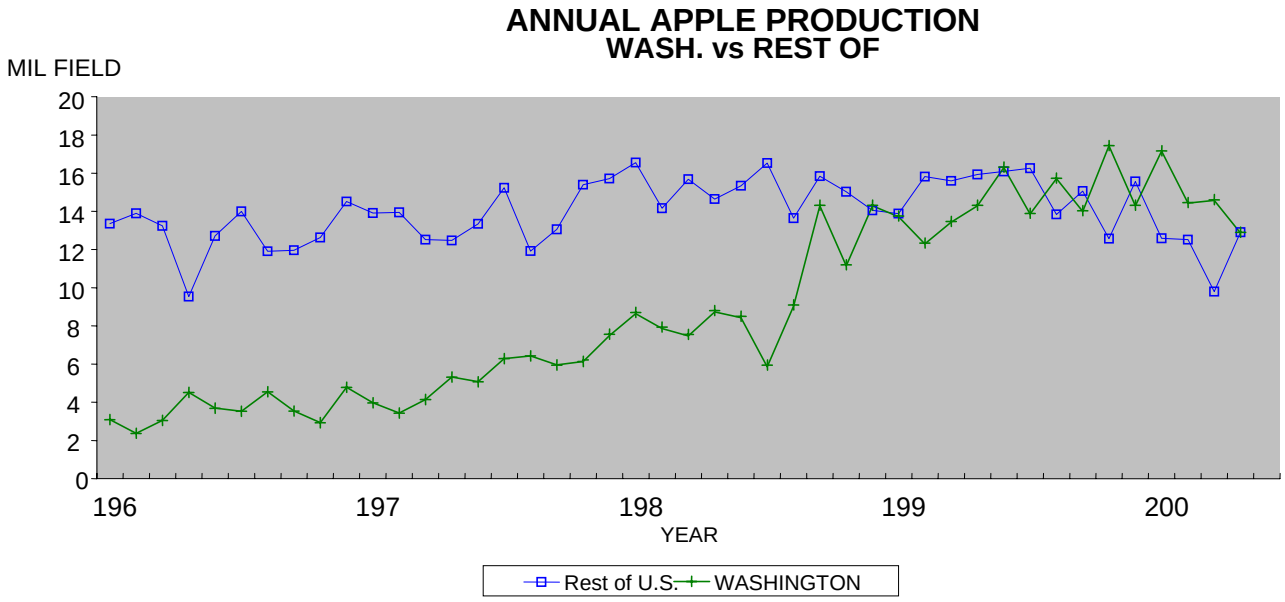
	1992			1997			2002		
	NO.	**ACRES**	**AVE.**	**NO.**	**ACRES**	**AVE.**	**NO.**	**ACRES**	**AVE.**
NCW	1868.00	57346.00	30.70	1546	55643	36.0	1290	44437	34.4
YAKIMA	1454.00	61910.00	42.58	1334	75264	56.4	1100	54036	49.1
NO. BASIN	271.00	26401.00	97.42	361	37072	102.7	329	40004	121.6
SO. BASIN	332.00	16093.00	48.47	379	27425	72.4	365	22211	60.9
OTHER	648.00	3315.00	5.12	565	4048	7.2	755	3633	4.8

Source: *Census of Agriculture. The 1992 census was published by the Bureau of the Census. The 1997 and 2002 editions were published by National Agricultural Statistics Service.*

U.S. AND WASHINGTON PRODUCTION

As implied in the previous section Washington production has generally been increasing since the mid-1950s. Figure 1 shows how Washington production has increased since 1960. That figure also shows production for the U.S. Since 1960 production in Washington has increased nearly 400% while production in the rest of the U.S. was declining slightly. Hence, Washington has captured all of the growth in the domestic market and taken a small portion of the market away from other growing areas. This is all the more impressive when population growth is considered. Since 1960 the U.S. population has grown by almost 100 million people.

Figure 1: Annual apple production.

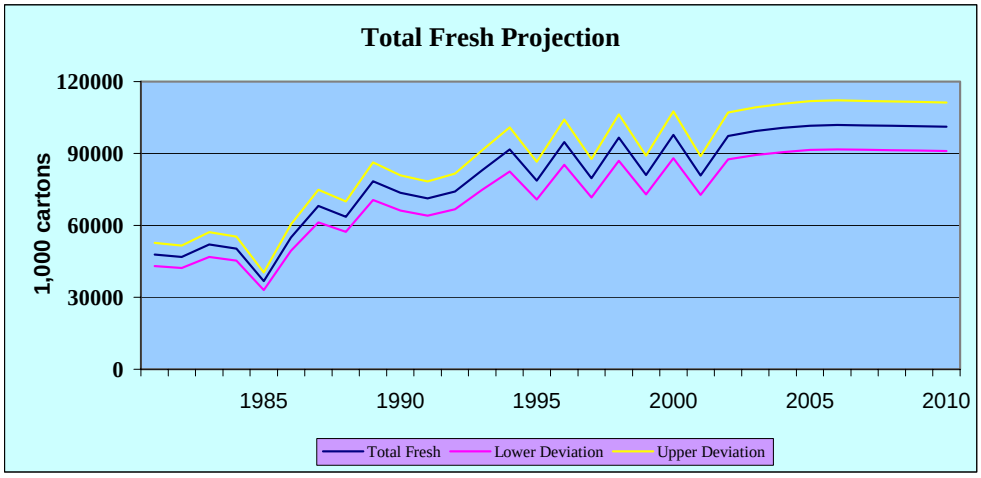


Source: USDA, NASS. Noncitrus Fruits and Nuts. Various issues.

The sawtooth pattern in Washington production during much of the 1990's is the result of biennial bearing. Apple trees have a natural tendency to have a large crop one year and a smaller crop the next year. This problem (and it is a problem) can be mitigated by careful management of the crop load each year through thinning and pruning. The relatively heavy planting of new trees during the late 1980's and early 1990's combined with somewhat less monitoring of crop load has caused this problem. Young trees are more prone to this problem and without very careful management alternate bearing occurs. As the trees mature the problem will decline as the trees become more stable in producing fruit. Economics is a factor here. Both thinning and pruning are expensive activities and when returns are really bad, such as during the late 1990's and early 2000's, there is a tendency for growers to scrimp on these activities which will exacerbate the problem.

While the industry has been in a growth mode for the past 40 years, it now appears that some downward adjustment in crop size is taking place. The removal of some 35,000 to 40,000 acres of apple orchard certainly reduces the crop potential. However, the impact of those removals is less than one might expect. The trees being removed were not producing as much fruit per square foot of orchard as the newer plantings. Using the data from the last fruit tree survey, surveys of nurseries by Lindsay Buckner at Treetop, Inc and the informal surveys on tree removals a spreadsheet model was built to project production and fresh equivalence (adjusted for cullage and converted to the number of cartons). Even with the acreage removals the potential crop size does not peak until 2006 and then slowly declines. Figure 2 shows the recent past history of fresh shipments (total crop) and the projections out to 2010. The potential for fresh crops similar in size to 1998 and 2000 still exists, but in light of the 2002 census numbers, less likely.

Figure 2: Total fresh projection.

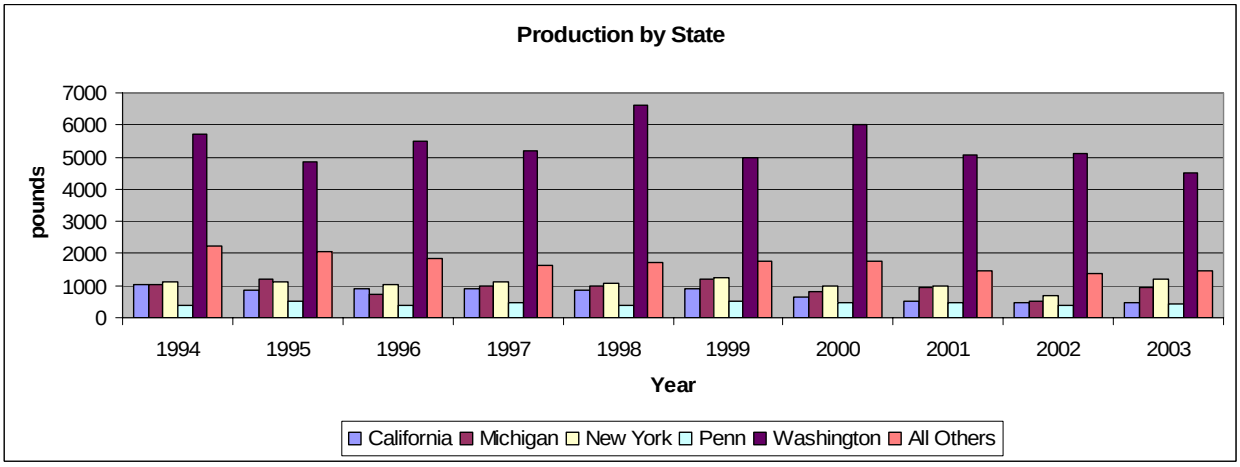


Source: http://www.agribusiness-mgmt.wsu.edu/AgbusResearch/docs/cropprojection97.xls.

Figure 3 provides a comparison of Washington and the other major producing states (New York, Michigan, Pennsylvania and California). Pennsylvania is included because growers in that state produce primarily processing varieties of apples. The slow demise of the processing industry is reflected in the production numbers for that state.

A careful review of Figure 3 will show that New York and Michigan have stable production, at best. Pennsylvania, California and the states in the “other” category are losing ground. California production seems to be the most volatile as producers in that state are more responsive to market conditions in terms of planting and removing trees. The current trend is down. That is due to the planting of some varieties in areas that are just too warm and do not color sufficiently to receive profitable prices. Some areas of California do produce a nice quality apple that can be harvested before fruit in Washington. That early harvest can generate profitable returns from sales to both the domestic and export markets. But it is essentially a niche market that does not appear to have significant growth potential.

Figure 3: Production by Washington and other major states.

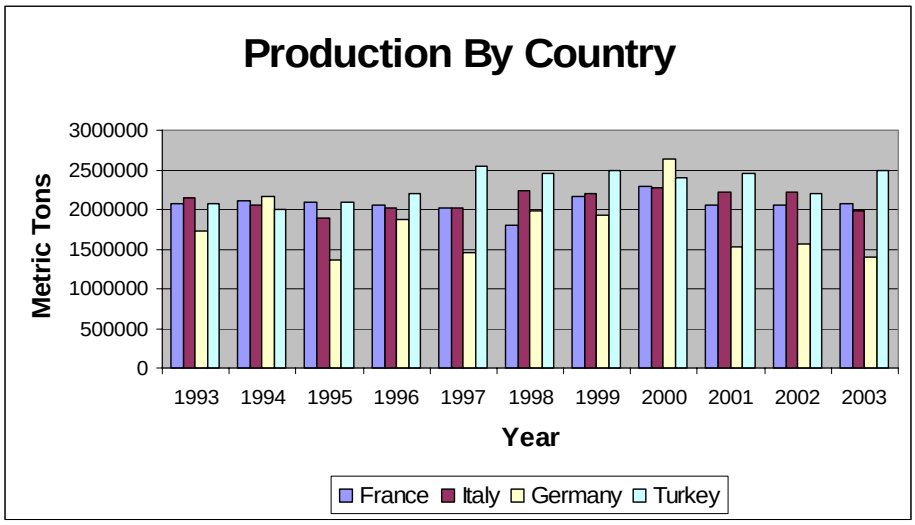


Source: USDA, NASS. Noncitrus Fruits and Nuts. Various issues.

WORLD PRODUCTION

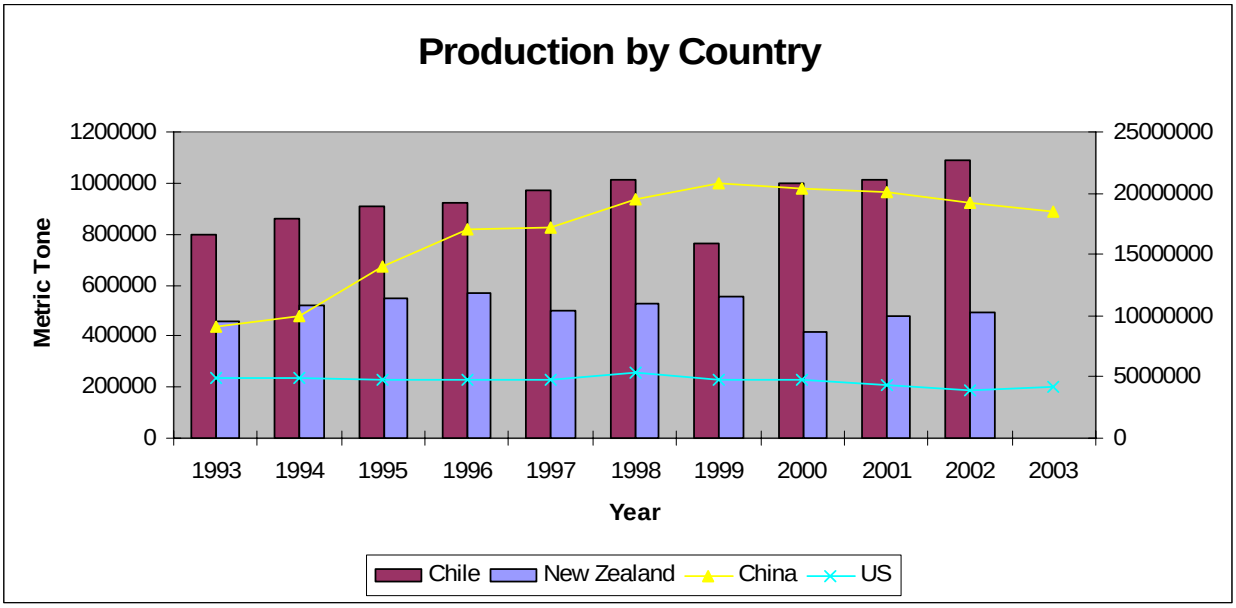
During the 1990's world production of apples grew rapidly achieving a 60% increase between 1992 and 2000. Since that time production appears to have declined slightly. Figures 4A and 4B show some history of production by major producing countries. In figure 4B the right vertical axis is associated with China and the U.S. The left vertical axis is associated with Chile and New Zealand.

Figure 4A: Production by countries.



Source: USDA, FAS. http://www.fas.usda.gov/psd/complete_tables/HTP-table6-102.htm.

Figure 4B: Production by countries.



Source: USDA, FAS. http://www.fas.usda.gov/psd/complete_tables/HTP-table6-102.htm.

Chinese production has gotten the attention of all other significant growing areas in the world. While Chinese producers and marketers have many problems to face, the sheer volume produced means that significant quantities of reasonable quality are available for sale in fresh form or for processing.

Because the infrastructure for packing, storing and shipping apples in China is still very poor the market season for their fruit is short and the returns quite low. This has led to the removal of some trees in the past several years. In addition, the national government has decided to promote the production of apples in only 2 of the 6 major producing provinces.[10] Those two provinces have about half of the acreage and half of the production. However, the continued reduction in acreage is more likely to be a function of the relative prices for apples and other crops that can be grown on the same land. The greater the profit potential from the other crops, the more likely trees will be removed. In fact, since the record 1999 crop in China each crop has been smaller (through the 2003 estimate which was 10% smaller than 1999).

There appears to be another constraint to large scale shifts in production in China. The village councils have some amount of influence in determining the crops to be grown. This makes it difficult for individual growers to make changes, especially when his/her small orchard is completely surrounded by the orchards of other villagers.

While international prices can be unprofitable, which would usually signal an excess supply problem, other countries, particularly in the European Union, subsidize growers in low price years. France, for example, will buy excess fruit ("withdraw from the

[10] USDA FAS. China, People's Republic of, Fresh Deciduous Fruit Annual 2002. GAIN Report #CH2045." September 19, 2002.

market") when crops are large. This artificially inflates grower returns mitigating the market signal (low prices) to remove some orchards.

While China appears to be in a position to dominate the world market because of their production potential and extremely low labor costs (labor in China does not get hourly or daily wages as it all comes from the household of the grower and is the residual recipient of any positive returns), there are several factors that favor Washington.

First, Washington has very favorable conditions for the production of apples. The dry warm summer environment with cool winters minimizes pest and disease pressures relative to all other growing areas, except Chile. This means that less effort is needed to control those problems and, of course, less expense.

Breeding programs in other parts of the U.S. and other countries are one good indicator of the significance of this difference. A major part of those breeding programs is to find new varieties that exhibit disease resistance. The goal is to find new varieties with acceptable eating characteristics that are disease resistant which will reduce production costs.

Chinese producers face the same problem as their summers tend to be hot and humid, an ideal environment for disease and insects. Because control materials are expensive, many growers in China have adopted the practice of placing the growing fruit in bags to reduce the damage caused by both disease and insects as well as minimize the amount of control material that gets on the fruit. Food safety is becoming a more important issue among affluent Chinese consumers.

In addition to having a better growing environment, the Washington industry has aggressively pursued improving those characteristics of the fruit that improve grower receipts. The highly colored Red Delicious apples are a prime example. Some other issues have arisen as a result of these efforts in terms of eating characteristics, but, unfortunately, those other factors have not been incorporated into the formula that determines how much a grower receives for the fruit. That being said, the industry has been moving ahead with the development and use of equipment that can evaluate each piece of fruit. Currently, equipment to measure color, shape, firmness and soluble solids is being used by, at least, some warehouses to enhance the eating experience as well as eye appeal.

The Washington Apple Commission has also played a key role in developing and expanding markets. As a result of their efforts Washington apples are recognized around the world. That recognition is so significant that shippers in other parts of the world have been caught illegally using the Washington logo or a very close facsimile. While the courts have limited the activities of the Apple Commission, it does continue to monitor the markets for illegal use of the logo.

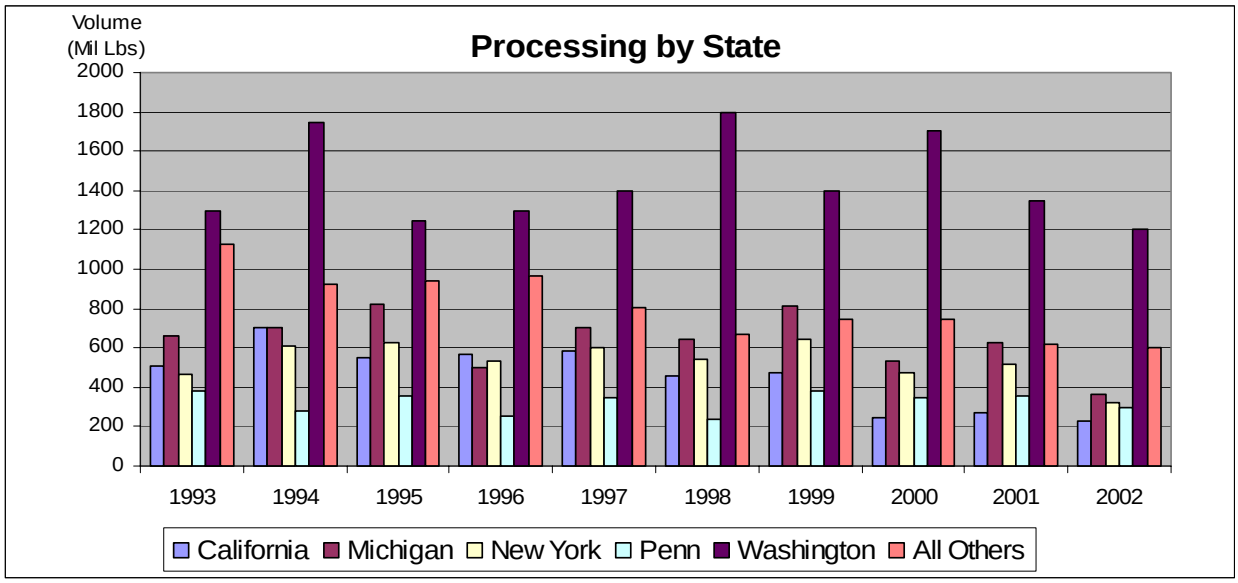
Over the next decade Washington production will likely stabilize as the industry worldwide adjusts to the new higher levels of production. The mix of varieties will continue to shift to a more uniform distribution across varieties, i.e. less emphasis on Red Delicious.

UTILIZATION

Processing

Processing utilization is a byproduct of producing for the fresh market in Washington. Very few, if any, growers produce apples for processing[11]. Yet, historically, this has been a significant market for Washington apples. Figure 5 shows the processing utilization by major state for the past ten crops. Washington's dominance is immediately obvious. Further, the general pattern for the other states is basically down. An upward trend can be observed in Washington's numbers as well as the wide swing in volume processed from year to year in response to the wide swings in production mentioned above.

Figure 5: Processing utilization by major state.



While most of this document focuses on the production and marketing of apples in the fresh market, some significant discussion of the processing sector is warranted as international trade is much more important on the processed side of the system.

Total fresh equivalent per capita consumption of apples in the U.S. is about 48 lbs[12]. Of that about 19 lbs is actually consumed fresh. Of the 29 lbs consumed in processed form only about 12 lbs are produced from domestically grown apples. Another 1 to 2 lbs are imported in fresh form and the remainder is imported in processed form, primarily juice concentrate.

Imported concentrate has increased about 50% in the last decade. This concentrate has, in recent years, been entering the market at prices significantly below the cost of producing and processing apples in the U.S. Even in years of short domestic crops

[11] In over 20 years of working with the Washington apple industry the author has never met a grower who was producing for the processing market.
[12] USDA, ERS, Fruit and Tree Nuts. FTS 290. October 2000

the price for juice apples, the predominant processed form, is usually below warehousing costs. During the fall of 2002 the price for juice apples in Washington was $50 per ton. It costs the grower $80 to $100 per ton to have the warehouse handle and sort the apples. When apples are reasonably profitable growers are willing to pay the warehouse rather than train the pickers to segregate in the field (and pay the picker more for that additional effort). While it seems like an irrational decision to let the warehouse do the sorting we do not know the cost of training pickers nor the additional cost of monitoring during harvest. When grower returns for fruit sold in the fresh market are very low greater emphasis is placed on delivering to the warehouse only fruit that is suitable for the fresh market. Hence, low juice apple prices have complicated harvest for growers.

Prices paid for apples to be used in other forms of processing (commonly called "peeler prices") are usually higher than the prices paid for juice apples. That pattern continues to prevail. Historically, the peeler market provided a competing outlet for those fruit that, while suitable for the fresh market, were generating FOB[13] prices that returned less to the grower than selling to the processor. However, there has been some decline in peeler prices with the result that fewer fruit are being diverted to that market and more are placed on the fresh market to the detriment of the grower through the negative impact on the overall price of the increased supply.

Because of the low price of imported concentrate, the processing sector is consolidating and shrinking. However, this is true only for those firms which produce the finished product, i.e. juice concentrate, etc. The processing sector can be broken into two major categories. First are the firms which produce the juice and other products from raw apples and then either sell those products in bulk or in containers for consumption. Some firms just perform the second step. They purchase concentrate and then package the product under their own or another label. This second group can purchase concentrate from any source, increasingly imported product.

Firms producing juice, and other products, in the Midwest and the East are legally bound to negotiate prices with growers each year. Those negotiated prices almost inevitably are substantially higher than prices paid in Washington and result in finished product prices that are not competitive with international prices. As a result processors are closing plants in those regions, in many cases eliminating the only buyer available to growers with processing apples.[14] Growers in states such as Pennsylvania and Virginia are suffering because of the loss of this market outlet.

In Washington, Treetop, Inc is the dominant firm in juice processing. A few other small firms are in operation, but Treetop is the primary buyer of apples for processing in Washington. This firm is a grower owned cooperative. Fruit from grower-members are purchased at open market prices with those dollars being remitted to the warehouse from which it was delivered. At the end of the marketing year grower-members receive an

[13] FOB means "free on board". Most sales in the produce industry are made under these terms. It means that the shipper is responsible for loading the truck (or rail car) and the buyer pays for the cost of transportation.

[14] Apple varieties are classified into three categories according to use: fresh, dual and processing. Dual varieties are suitable for both fresh consumption and processing. Golden Delicious is a good example of a dual variety. A variety classified as a processing variety does not have good fresh eating characteristics and is not sold in the fresh market. When a processor ceases operation, growers who formerly supplied processing apples to that processor now have fruit with essentially no economic value.

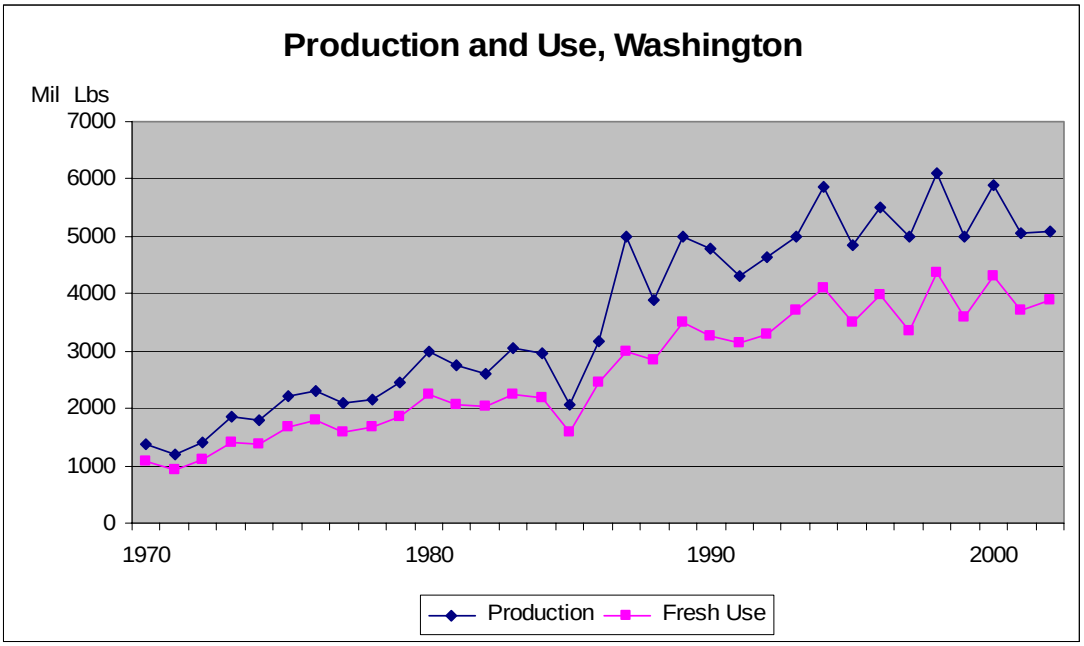
additional payment based on the amount of profit generated by the firm. Even with the patronage payments (payments made by cooperatives to members that are akin to dividends from investor-owned corporations) the amount received by growers does not match the contract prices paid in the Midwest and East. In recent years contract prices for juice apples in those areas have been around $180 per ton.

Processing utilization of apples will continue to be an important feature of the Washington industry. However, international competition will continue to impact the economics of apple production. To the extent that low returns from the fresh market continue to plague the industry, growers will be more mindful of the losses associated with the processing market. Harvest practices will be adjusted in an attempt to reduce these losses. Harvest laborers will likely be an important part of these changes.

Fresh Utilization

The fresh market has always been the focus of Washington apple growers. Figure 6 shows how dominant that outlet has been over the past 30 years. While the processing sector has grown, it seldom absorbs more than 30% of the crop. For the last ten years fresh use of Washington apples has been fairly steady at 71 to 72% of the crop. As the industry adjusts it's productive capacity it is likely that a larger proportion of the crop will be used fresh as opposed to processed. Shorter crops generally mean higher prices in the fresh market which, in turn, reduces the shippers' willingness to provide fruit for processing.

Figure 6: Production and use in Washington.

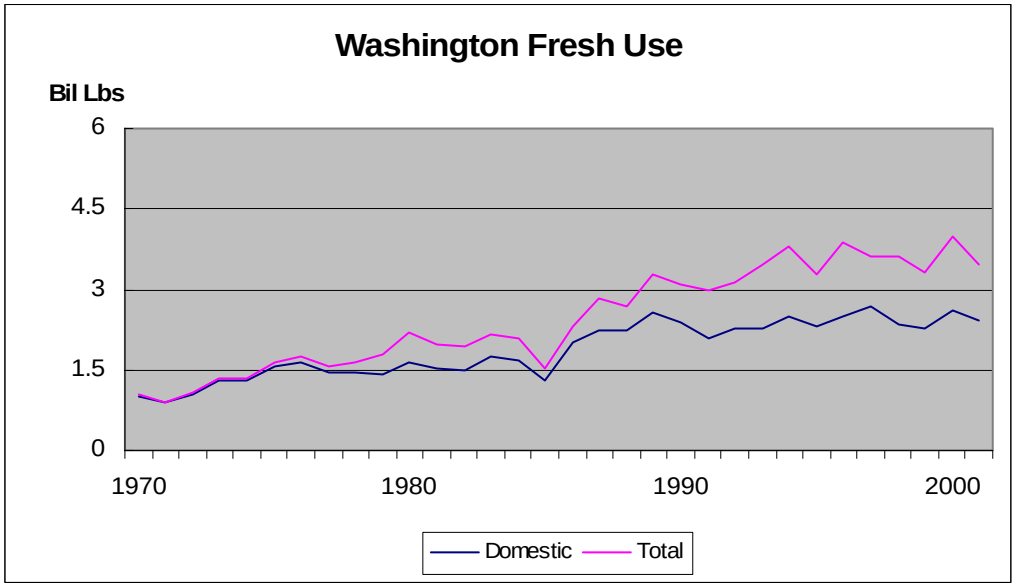


Source: USDA, NASS. Noncitrus Fruits and Nuts. Various issues.

Of more concern to the industry is the movement of apples to the fresh market as seen in Figure 7. The top line in this figure represents total fresh shipments annually as reported by the industry. The bottom line reflects movement into the domestic market.

The difference, then, is the volume exported. While Washington has been exporting apples since the 1920's real interest in that market did not begin until the late 1970's and early 1980's. That trend becomes more obvious when the reader understands that the crop in 1985 was severely shortened by a late spring freeze in the Yakima Valley. The small crop and higher prices dramatically reduced export sales that year. In the years since then exports have grown to the point where they routinely represent more than 30% of the total fresh use.

Figure 7: Fresh use of Washington apples, measured by fresh shipments.



Source: Wenatchee Valley Traffic Association.

The building of the export market for Washington apples has to be viewed as a major success. However, it also has to be recognized that success is due to the ability of the industry to expand the total market by opening more and more countries to the sale of apples. The final major potential market, India, has been opened and is now buying apples from Washington. Since Washington apples can now be exported to nearly every country further short run expansion will have to come from tariff reduction. China, for example, has had high tariffs on apples which are now expected to be reduced as a condition of China's admission into WTO.

The vagaries of the international market are reflected in the wide swings in shipments from year to year. The best export successes have been with newly developed or developing countries. Incomes in those countries are growing, but still low. This makes those countries much more sensitive to changes in prices and exchange rates. That responsiveness can be seen in the way volume exported changes from year to year. It is also useful to compare those year to year changes with changes in domestic shipments. The domestic market is much less responsive to price change.

Given that the apple industry has few new markets to open future growth will have to come from the reduction of phyto-sanitary restrictions (e.g. the Japanese protocol for ensuring that fire blight is not exported to that country) that appear to be excessive and

from further reduction of tariffs. The only other likely source of growth is through the income effect which is truly long term.

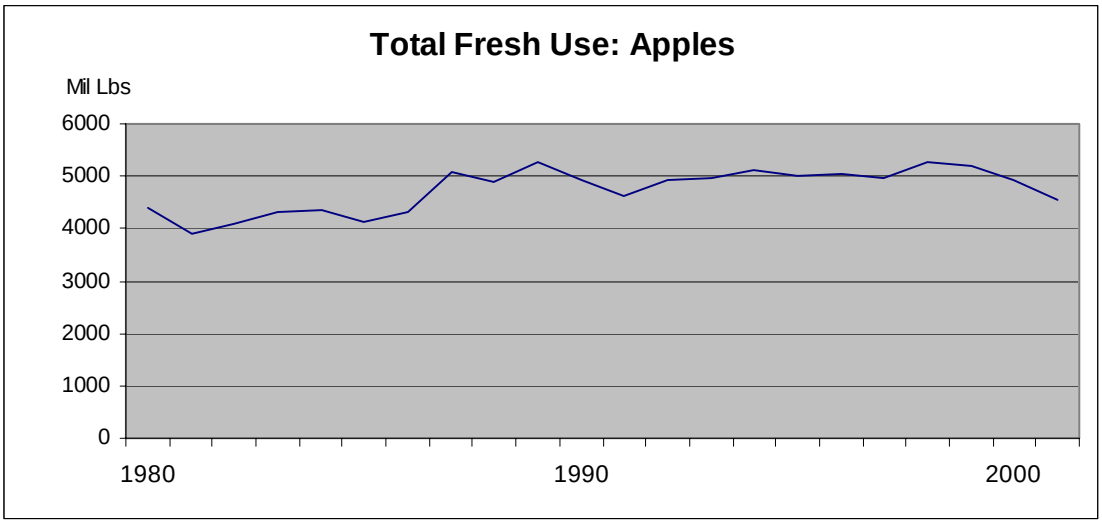
With the entrance of China into the international market for fresh apples the ability of Washington to maintain market share is being severely tested. Chinese shippers have been attempting to build market share in south and Southeast Asia. In addition to having a freight advantage into that region Chinese costs of production are very low. It has been reported that Chinese fruit are being exported at prices about 60% below the international market.[15] Price sensitive markets have already increased their purchases of Chinese fruit. Fortunately, politics have affected China's ability to compete in Washington's most important market in that region, Taiwan.

Because of Washington's ability to produce large quantities of high quality fruit, it is unlikely that the Asian market will discontinue buying apples from Washington. However, the Washington industry will need to adjust expectations and strategies to continue to be the preferred supplier for some part of that market.

In fact, since 2000 Washington apple growers have reduced productive potential (removed orchards) and have also reduced reliance on the international market. By the end of the market season for the 2003 crop the proportion of the crop exported was below 25%.

Taking a longer term perspective, it is obvious in Figure 7 that domestic fresh use of Washington apples, as measured by fresh shipments, has grown significantly over the past 30 years. However, after a significant upward shift in the late 1980's shipments have not improved. The graph would suggest that there is a ceiling to the volume that the domestic fresh market will accept, a ceiling that may only respond to increases in population.

Figure 8: Volume by crop year for fresh use of apples in the U.S.



Source: Based on data reported by Foreign Agricultural Service, USDA.

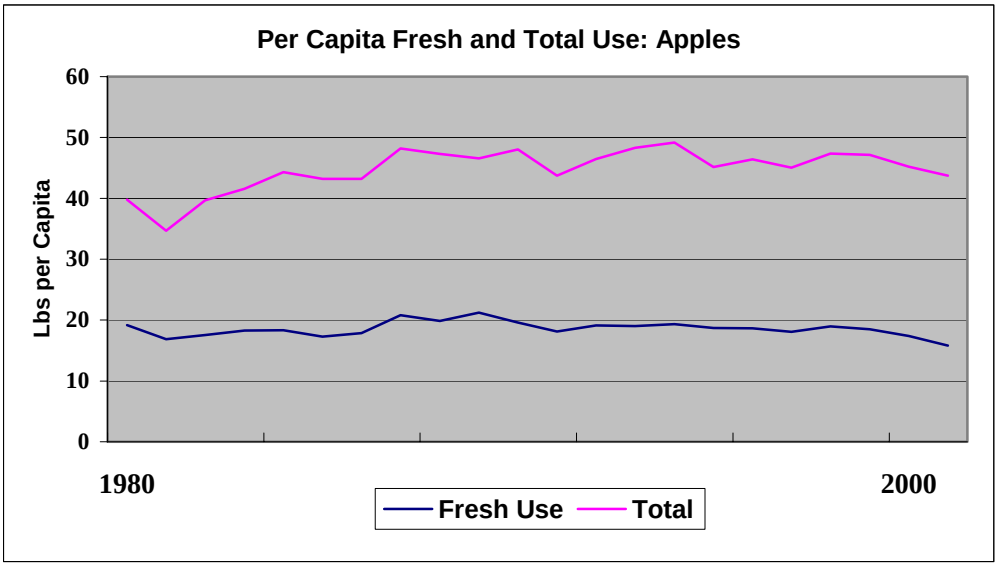
[15] USDA, FAS China, People's Republic of, Fresh Deciduous Fruit, Annual, 2002. GAIN Report #CH2045. 9/19/2002

While Washington is the biggest player in the domestic apple market, it is useful to consider the total volume being utilized fresh in the U.S. each year. Figure 8 shows the volume by crop year (1980 means the market year for the crop that was harvested that year). The total volume each year is determined by combining total fresh volume plus imports and deducting exports. Total fresh disappearance during the 1980's trended upward. However, that trend disappeared in the 1990's and became flat until the really large crop in 1998. The decline since then was due to shorter domestic crops with only limited increase in imports. The lack of response on the part of growers in other countries (principally Chile and New Zealand) was due to very poor prices. Overlapping crops between 1998 and 1999 likely exacerbated the problem. The result was lower than expected FOB prices during the 1999 season which discouraged imports.

The other way to view use is with per capita use data. Figure 9 shows per capita fresh use and total per capita use. This figure suggests that fresh use per person has actually been slipping for the past several years. The total use follows the same pattern and has actually suffered a slightly larger absolute drop than fresh use. However, because of the growth in juice consumption (13 lb, fresh equivalent, in 1980 to 21 lb in 2001) total disappearance has actually increased (i.e., absolute volume). Keep in mind that the increase in total disappearance has largely been supplied by product from offshore.

Appendix Table A1 contains the data from which Figure 9 was developed. Strictly speaking, the fresh consumption data measure disappearance rather than actual consumption. Some small amount of fruit becomes spoiled and is discarded. Actual per capita consumption is, accordingly, slightly less than the figures reported here.

Figure 9: Per capital fresh use and total per capital use of Washington apples.



Source: http://usda.mannlib.cornell.edu/data-sets/specialty/.

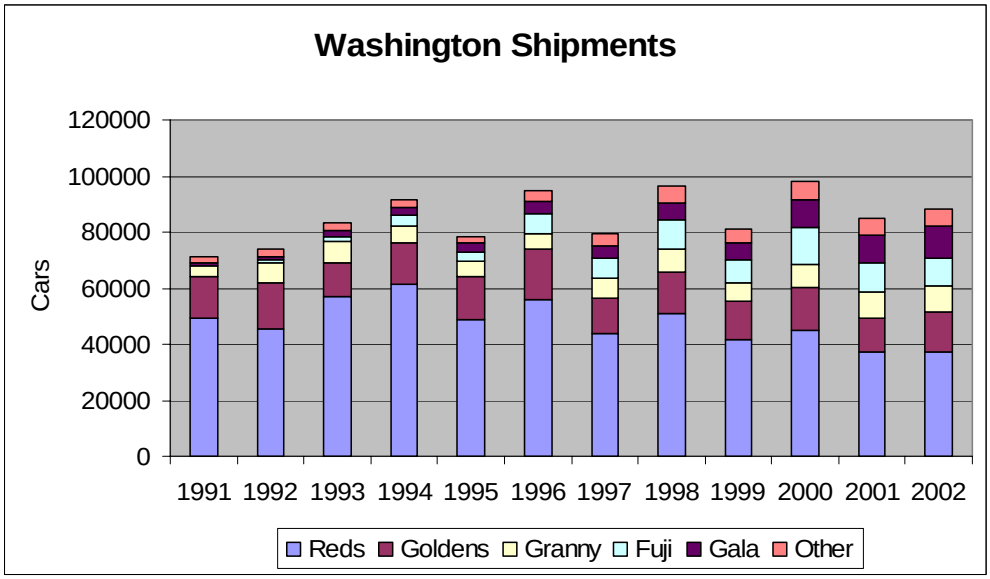
Varietal Shifts

Varietal information is much more interesting, but data on production and movement by variety are no longer reported publicly. The following discussion and figures are based on data gathered within the industry.

Figure 10 shows how the industry is reducing reliance on Red Delicious. In place of Red Delicious the industry is shipping more Fuji, Gala, Granny Smith and other unspecified varieties like Braeburn, Jonagold, Cameo and Pink Lady. While Golden Delicious production is declining, it is not falling as fast as Red Delicious. A careful review of this figure will show how the changes are occurring fairly rapidly. In 1992 Gala shipments barely registered on the chart and Fuji's had not yet reached a significant level of volume. Granny Smith production had actually become excessive in terms of what the market was willing to accept at a breakeven, or better, price in the early 1990's and some acreage was removed. Prices have since improved and there has been some new acreage of Granny Smith planted.

The legend in Figure 10 begins with the bottom portion of the bars (Red Delicious) and moves up. Hence, the uppermost portion of the bar for each year represents the "other" category.

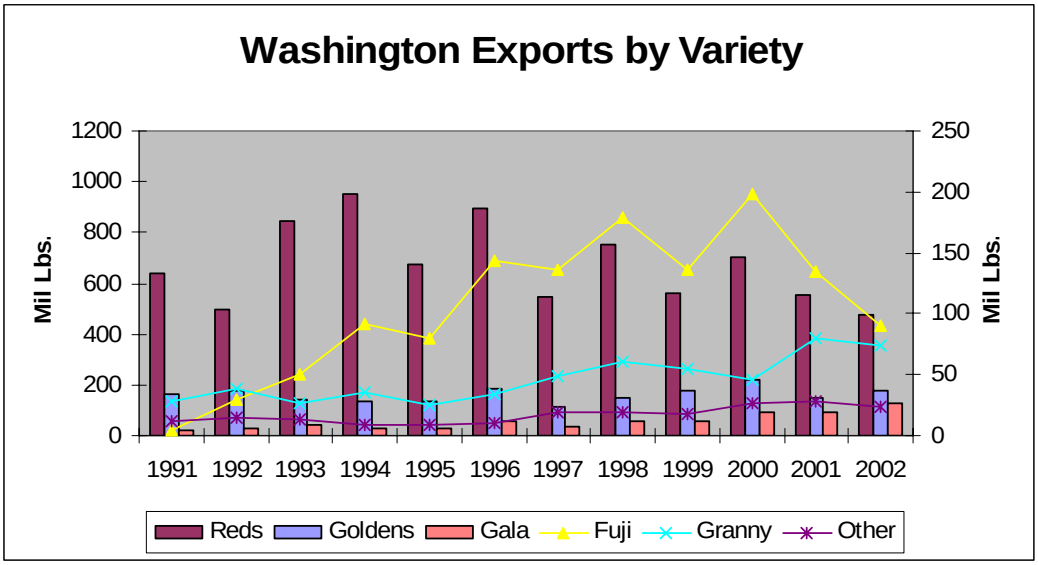
Figure 10: Decrease in industry demand for Red Delicious.



Source: Washington Growers Clearing House Annual Summary, various editions.

Shipments by variety by destination also show the changes that are occurring within the industry. Figure 11 shows export movement by variety for the past 11 years. The five major varieties and an "other" category are shown. The "other" category contains all other varieties that were exported. Note that the bars are associated with the left vertical axis and the lines are associated with the right-hand vertical axis.

Figure 11: Export movement by variety.



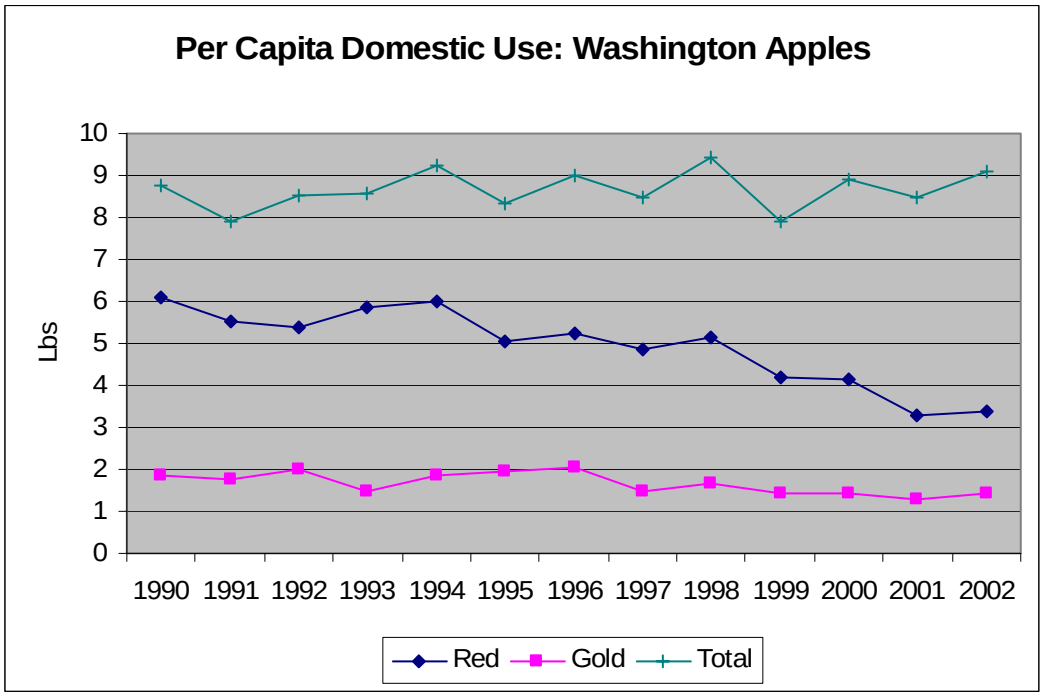
Source: Wenatchee Valley Traffic Association and Washington Apple Commission.

Fuji exports have undergone phenomenal growth in the past decade, reaching nearly 5 million cartons in 2000. However, since that time short Fuji crops and Chinese competition have caused a drop in Fuji exports. Red exports have declined about 45% since the peak year of 1994. Both Granny Smith and Gala have also experienced significant growth in exports.

Using recent past history to project future movement of Fuji's in the export market may offer a fairly clear picture of the near term future. Most Fuji's are sold to Asian buyers. The number 1 variety, at least in the two top producing provinces in China, is Fuji. As China builds its capacity to export into the rest of Asia, fruit from Washington will be at a disadvantage in terms of price. Quality may become very important in Washington's efforts to cling to significant market share.

Shifting to the domestic market, the next two figures show the trends in total and major varietal consumption per capita of Washington apples. Figure 12 shows per capita fresh shipments for Red Delicious, Golden Delicious and all varieties of Washington apples. Over the past decade total consumption appears to be trending slightly upward. However, both Reds and Goldens are losing market share. In a twelve-year time span Red consumption has declined by about 1/3. Since 1996, the chart suggests that consumption of Goldens has declined about 30%.

Figure 12: Fresh consumption per capita for Reds, Goldens, and all varieties.



Source: Unpublished industry data.

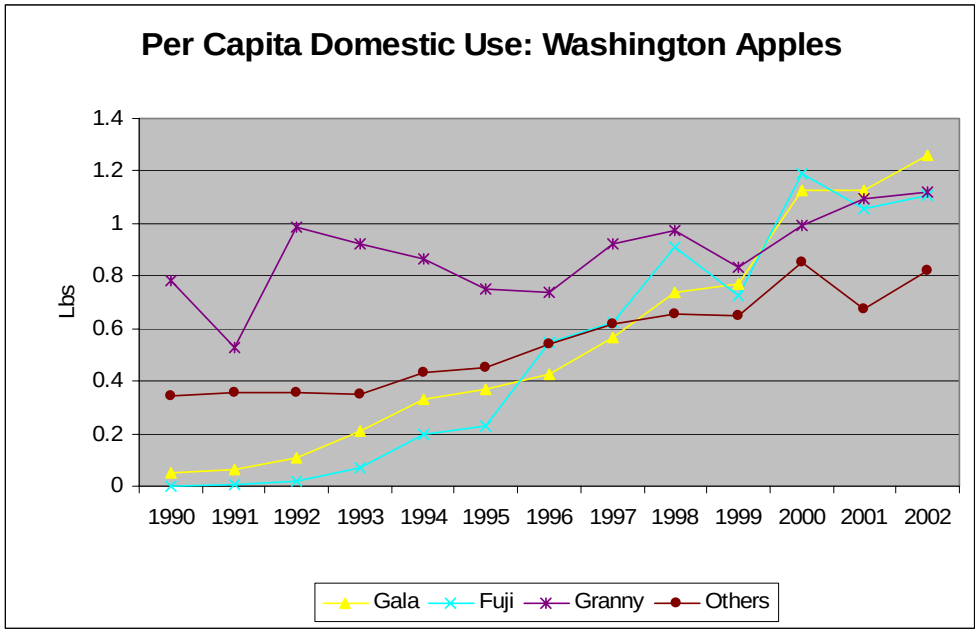
Much discussion has taken place in recent years about potential solutions to the decline in Red Delicious consumption. Quality has been center stage in these discussions. However, taking a longer view of the industry, it may be time to accept the idea that Reds, and possibly Goldens as well, may be obsolete. Red Delicious, and standard Delicious before it, has been the dominant variety in the U.S. for over 60 years. The market certainly favored Delicious in the 1920's (high prices relative to other varieties), but actual production data are not available that far back.

Figure 13 shows the growth in consumption on the newer varieties. Gala and Fuji use have grown very quickly. Granny Smith consumption has returned to, and surpassed, the level first achieved in 1992. The growth in the really new varieties (Cameo, Cripps, Pink, etc.) has more than offset the decline in use of the really old varieties (Winesap and Red Rome, etc.).

The newer varieties, starting with Gala, inspired optimism in the industry regarding consumption. It was hoped that as consumers became acquainted with these new varieties total consumption would increase. These data do not support that optimism. It appears that consumers are merely trading old for new. At the same time improvements in fruit quality that are on the horizon may lead to increased consumption.

Figure 14 takes a different perspective of fruit consumption in the U.S. It shows per capita shipments by region. On a per person basis the West uses much more Washington fruit than the other regions. Further, western use appears to be trending upward. The northeast and the southeast lines suggest some modest improvement in consumption in those regions as well. Southwestern use appears to be flat at best and use in the Midwest has fallen since 1994.

Figure 13: Growth in per capita domestic movement of newer varieties.



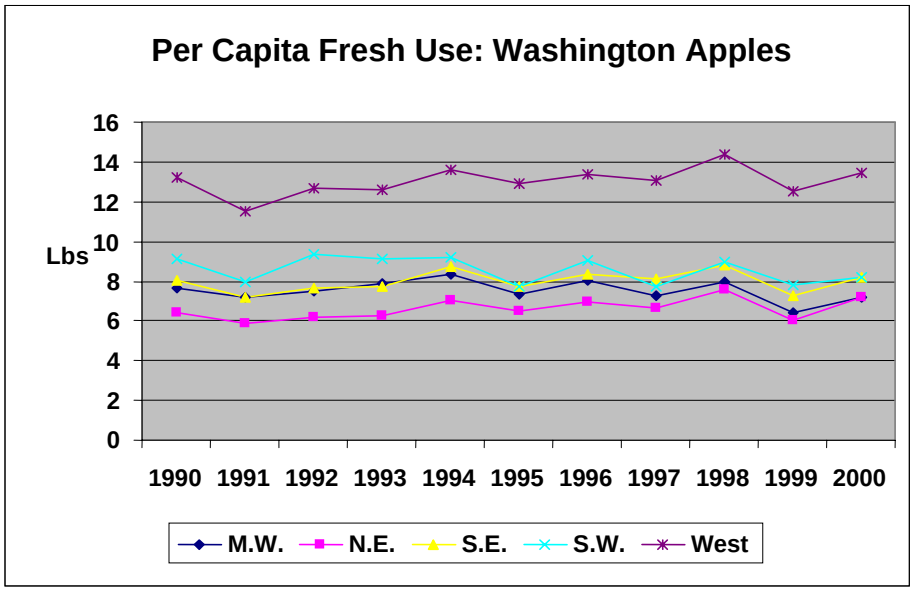
Source: Unpublished industry data.

Given the success in introducing the new varieties in the West the optimism about expanding consumption may be warranted. Obviously, the key is building consumer awareness.

The difference in consumption levels among regions and particularly between the west and the northeast and Midwest deserves specific mention. The list of varieties produced in Michigan and New York is much longer than the list for Washington, Oregon and California. The flavors and eating characteristics of McIntosh, Spartan, Paula Red and Empire, for example, are sufficiently different from Red Delicious, Golden Delicious, Granny Smith, etc. to create a bigger challenge in inducing consumers to adjust preferences. It seems that consumption habits learned at a younger age, at least with respect to apples, tend to carryover into the older years. Growers in British Columbia have found and cultivated a market niche in southern California and Arizona for McIntosh. Former residents of the Northeast who have retired to these warmer climes still prefer the McIntosh. This suggests that additional effort is needed to increase consumer familiarity with the new varieties before increased use can be expected.

In perspective, the issue of use patterns reflects the state of flux in which the industry finds itself. The varietal shifts are a measure of grower response to market signals which will be discussed later.

Figure 14: Per capita apple shipments by region.



VARIETY INFORMATION

This discussion is meant to be a brief description of apple varieties. At best it will help the reader achieve some minimal awareness of the complexity surrounding this subject. Describing several varieties and their origins barely scratches the surface.

Over time chance mutants of varieties are found which have some desirable characteristic in greater abundance than the original. For example, there are over 100 strains or mutants of Red Delicious had been identified by 1981[16]. Each strain was thought to have the capacity to produce fruit with higher color or better shape on a consistent basis. These changes were viewed as improving grower returns. Similarly, new strains of Fuji and Gala have been found that consistently produce fruit with more color. Those better coloring strains are sufficiently better to induce some growers to remove their earlier plantings and replace them with the newest strains, even though the original planting may have only been 12 – 15 years old.

While not strictly correct, apples generally require cross-fertilization to produce fruit. This can be done several ways. In some cases individual pollenizer trees will be "scattered" about the orchard in a systematic fashion (every fourth tree, every fourth row, for example). Sometimes, branches of pollenizers are grafted onto some of the trees in the block. In still other cases one row of pollenizers will be planted for every four rows of preferred variety. As the amount of space taken up in the orchard by the pollenizers increases, there is a greater tendency to use varieties with reasonable commercial value. In recent years it has been common to see rows of trees removed while other rows are left in place. Typically, these are Red Delicious blocks with Golden Delicious as pollenizers.

[16] Fisher, D.V. and D.O. Ketchie. Survey of Literature of on Red Strains of 'Delicious'. Washington State University College of Agriculture Research Center. Bulletin 0898, 1981.

Golden Delicious prices have been sufficiently good to induce growers to leave the Goldens while removing the Reds.

A critical issue with respect to pollenizers is the timing of bloom. If the pollenizers do not bloom at the same time as the main variety, pollination cannot occur.

At the other end of the growing season harvest dates vary by variety. Figure 15 shows typical harvest periods for a set of varieties in central Washington. This particular chart was taken from the website for Willow Drive Nursery in Ephrata, WA. This and much other information can be found on the websites of most fruit tree nurseries.

The timing of harvest has become increasingly important as the supply of pickers has become more uncertain, or, at least, unevenly distributed across the industry. When Red and Golden Delicious dominated the acreage harvest basically began in early September and ended in mid-October. Some variation in the timing of harvest did occur, but this was due to differences in elevation. Fruit on trees at higher elevations mature later than fruit at lower elevations.

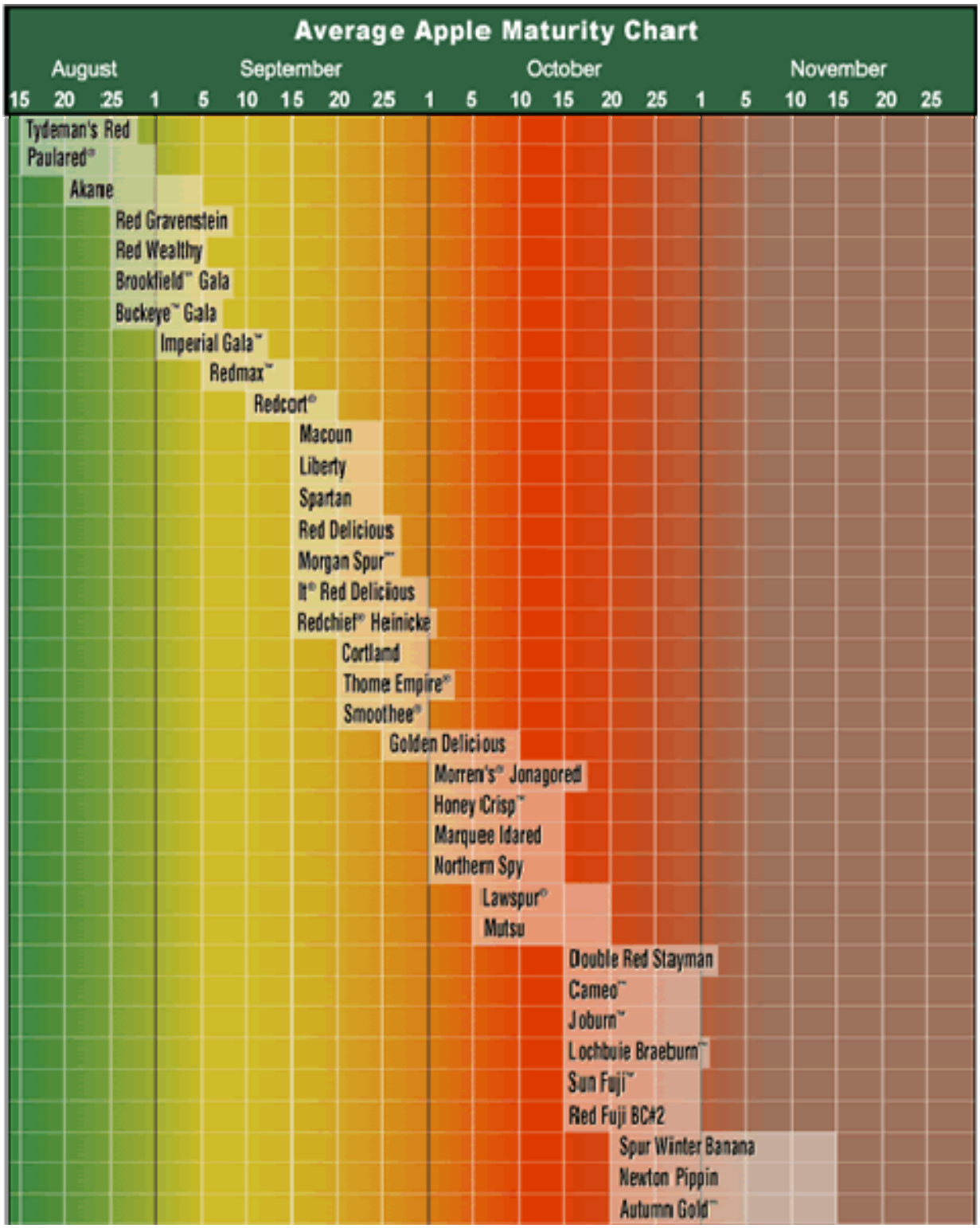
The need for harvest help was condensed into a relatively short period of time which resulted in the need for more laborers during harvest. As can be seen in Figure 15, by planting several different varieties growers can reduce the total number of people needed to harvest the crop. At the same time it provides employment for a much longer period of time. Agricultural census data show that, in fact, this is exactly what is happening in the industry. The number of people working less than 150 days per year in the industry has been declining, while the number of people working more than 150 has been increasing. There are still many more short-term opportunities, but the trend is obvious.

New varieties are developed in breeding programs. Given the interest in finding new varieties with market appeal, breeding programs may become the major source of new varieties.[17] However, in the past, new varieties have often been found by chance. Table 3 shows the parentage of the most common varieties in Washington and the year in which each was introduced in the market. Of the nine varieties listed five were found as chance seedlings. Three of the five are suspected to have come from the indicated parents (those parents followed by question marks).

Chance seedlings are trees that grew from the seed of an apple that fell to the ground. In each case the trees were allowed to grow and, by chance, the fruit proved to have desirable eating characteristics. It is by chance that the trees were allowed to grow and that the fruit proved to have significant market value. For example, it is said that the original Delicious tree grew from a seed in a small orchard. The owner of the orchard cut the seedling down twice and it came back both times so he decided to let it grow.[18]

[17] For a discussion of the techniques of breeding apples, see, for example, Westwood, M. N. Temperate-Zone Pomology Physiology and Culture. Timber Press. Portland, OR.
[18] Luce, W.A. Washington State Fruit Industry, a Brief History. *Good Fruit Grower*, n.d., p. 13.

Figure 15: Typical harvest periods for a set of varieties in central Washington.



Source: http://www.willowdrive.com/.

Table 3 : Parentage of selected varieties.*

Variety	Parentage	Market Introduction
Red Delicious	Chance seedling	1874
Golden Delicious	Golden Reinetta and Grimes Golden (?)[1]	1914
Gala	Cox Orange Pippen and Golden Delicious	1965
Fuji	Red Delicious and Ralls Janet	1962
Granny Smith	French Crabapple (?)	1868
Braeburn	Lady Hamilton and Granny Smith (?)	1952
JonaGold	Golden Delicious and Jonathan	1968
Pink Lady	Golden Delicious and Lady Williams	1985
Cameo	Chance seedling	1987
Honeycrisp	Honeygold and Macoun	1991

** Source: http://www.bestapples.com/varieties/index.html.*

[1] A question mark indicates suspected, but unknown, parentage.

Note how long each variety has been available in the market. Growers are always searching for the next "hot" variety. However, history suggests that successful new varieties are slow to appear and at a seemingly random pace. Gala and Fuji are becoming very important varieties in Washington and they were first introduced to the market 40 years ago. Granny Smith had actually been available for 100 years before it appeared on the U.S. scene.

While new varieties will continue to appear, and possibly at a faster pace (Washington Stat University established it's first apple breeding program several years ago.), there is a greater likelihood that new strains of the established varieties will appear at a faster pace. Just as the industry strove to increase the amount of red in Red Delicious over the years, the same pressure is occurring with Fuji and Gala. Some growers are already removing the oldest strains of both varieties and replanting with new strains that produce more color. As much as the industry may grumble about color, it is still true that more highly colored apples command a higher price. That powerful incentive will induce growers to strive for better color.

Because strains represent some inherent improvement over its parent, they should not be compared to the development of new varieties. New varieties represent the attempt to create a new combination of apple characteristics that meet the wants of consumers in terms of eating qualities and appearance. With the increased understanding of consumer preferences (or, rather, the range of preferences) breeders have a better chance of selecting profitable varieties.

INDUSTRY ORGANIZATIONS

The remainder of the report will follow the flow diagram (Figure 16) in terms of organization. However, some brief discussion of the organizations within the industry is warranted. A number of different organizations have been formed down through the years to address issues of particular concern at the time.

The Washington State Horticultural Association is the oldest industry organization. Membership is voluntary. The primary source of income is member dues. In addition to sponsoring a combined meeting for producers and the warehouse industry each year, the association has several standing committees to deal with issues pertinent to the industry. The education committee is in charge of the combined meeting. The Environmental Affairs committee handles crop protection and Postharvest issues. The governmental affairs committee has responsibility for labor and water issues. The grade and pack committee is charged with handling grade standard issues and packing problems.

For many years the Washington Apple Commission had responsibility for promoting Washington apples in domestic and export markets. Its representatives around the world maintained contact with retailers and wholesalers and gathered market information which was shared with the industry. It was recognized as among the best of the commodity promotion groups. Revenues for commission activities were, and still are, generated by a per box assessment on all apples sold. The commission was established by the Washington legislature and has the legal authority to collect an assessment. In recent years the commission has been successful in attracting Market Access Program funds from the USDA to supplement grower monies for promotion activities in other countries. The commission has the largest budget of any industry organization and uses part of their monies to support the Northwest Horticultural Council and the U.S. Apple Association, a national industry organization, among other organizations.

In 2002 the Washington Apple Commission went to court to test the validity of its “rights” to promote Washington apples using monies taken from all growers. In essence, the (federal) court ruled that it was unconstitutional for the Apple Commission to force growers to support the promotional programs. It ruled that the free speech rights of some growers were violated and ordered the Apple Commission to discontinue all domestic promotion activities and to have the Washington legislature pass new enabling legislation that did not include any mandate for domestic promotion.

In its “new” form the Washington Apple Commission has become a bona fide state agency. It still has authority to collect assessments based on apples sold. Currently, (2004) the assessment rate is approximately $0.035 per 40 lb. carton. Those monies are being used to support selected industry organizations, to meet the “match” needs associated with using federal dollars to promote Washington apples in foreign markets and to guard against the pirated use of the Washington logo. The assessments may also be used to support research projects.

The Northwest Horticultural Council speaks on behalf of the northwest fruit industry on national and international issues relevant to the fruit industry. In recent years trade barriers and unreasonable phyto-sanitary regulations enforced by importing countries have been a major focus of the council.

The Washington Tree Fruit Research Commission is funded by grower contributions to conduct and sponsor research on the production of Washington tree fruits and the postharvest handling of those fruit. Because of the finite life of most control materials and the desire of growers to minimize use of these materials much of the activity funded by the Research Commission has been focused in the general area of pest management and disease control.

The Washington Growers Clearing House is a nonprofit organization of apple, pear, and cherry growers. It was formed originally to gather and distribute price and movement information to growers. It continues to distribute that information on a weekly basis. The Clearing House has been an active participant in working through labor related issues. It also lobbies on behalf of its grower members at the local and state level.

There are two associations of shippers. One is located in Yakima and represents shippers in the Yakima Valley (Yakima Valley Grower-Shippers Association). The other is located in Wenatchee and represents the warehouses in north central Washington (Wenatchee Valley Traffic Association). These associations have a variety of responsibilities but the key activity is to track shipments on a timely basis and report the information back to their members.

In response to the economic crisis that hit the industry in 1998, a new organization was established. This organization is a co-operative. This is the critical feature as it gives its members the right to discuss price without fear of antitrust action. This new co-operative performs two valuable functions. It provides a forum within which prices are discussed and guidelines developed. Sales activities are monitored and sales made outside the guideline ranges are questioned. Occasionally, shippers will sell some small volume at prices below the market because the fruit have some defect or pending defect (i.e. firmness is declining and the fruit must be sold before going out of grade). Buyers will, on occasion, use asking price for such a sale to attempt to purchase “good” fruit at a lower price. In the past there was no mechanism for other shippers to verify the prices quoted by buyers as to accuracy and quality. Washington Apple Growers Marketing Association (WAGMA) can talk to individual shippers to determine details of the sale and share those details with the rest of the membership. Just this one activity helps level the playing field by increasing the amount of information available to shippers.

WAGMA also establishes price goals for the season based on knowledge of the crop in Washington and the rest of the U.S. These goals are established as a price range by grade and by size, at least, for the most popular combinations. Both prices and movement are monitored weekly to ensure timely clean up of the crop.

There are several organizations within the industry representing subsets of people or warehouses. These groups are generally very low profile and their activities seldom discussed in public.

THE APPLE MARKETING SYSTEM

Earlier sections focused on the supply and use of apples. This section will look at the full system as a supply chain.

The produce system, in general, is fairly generic, particularly for the primary items in the retail produce section. Crops are grown, harvested, packed and shipped to retailer distribution centers. The loads are subdivided and sent to individual stores.

Traditionally, produce is bought and sold on the spot market. A buyer contacts a shipper's salesman (or vice versa) and if that shipper has the desired product available and a price can be negotiated, the sales agreement is completed. The next time the buyer needs that product a new sales agreement is negotiated.

Prior to WWII most produce was sold at auctions in the major markets. After the institution of price controls during WWII buyers started calling the shippers directly to ensure that sufficient supplies were in the retailer's inventory.

The spot market method of selling is starting to evolve into a more structured system where contracts are becoming more important. While the evolution started before WalMart began selling food, the entry of this firm into food retailing, with its supply chain approach, has hastened the shift to more formal selling/marketing agreements.

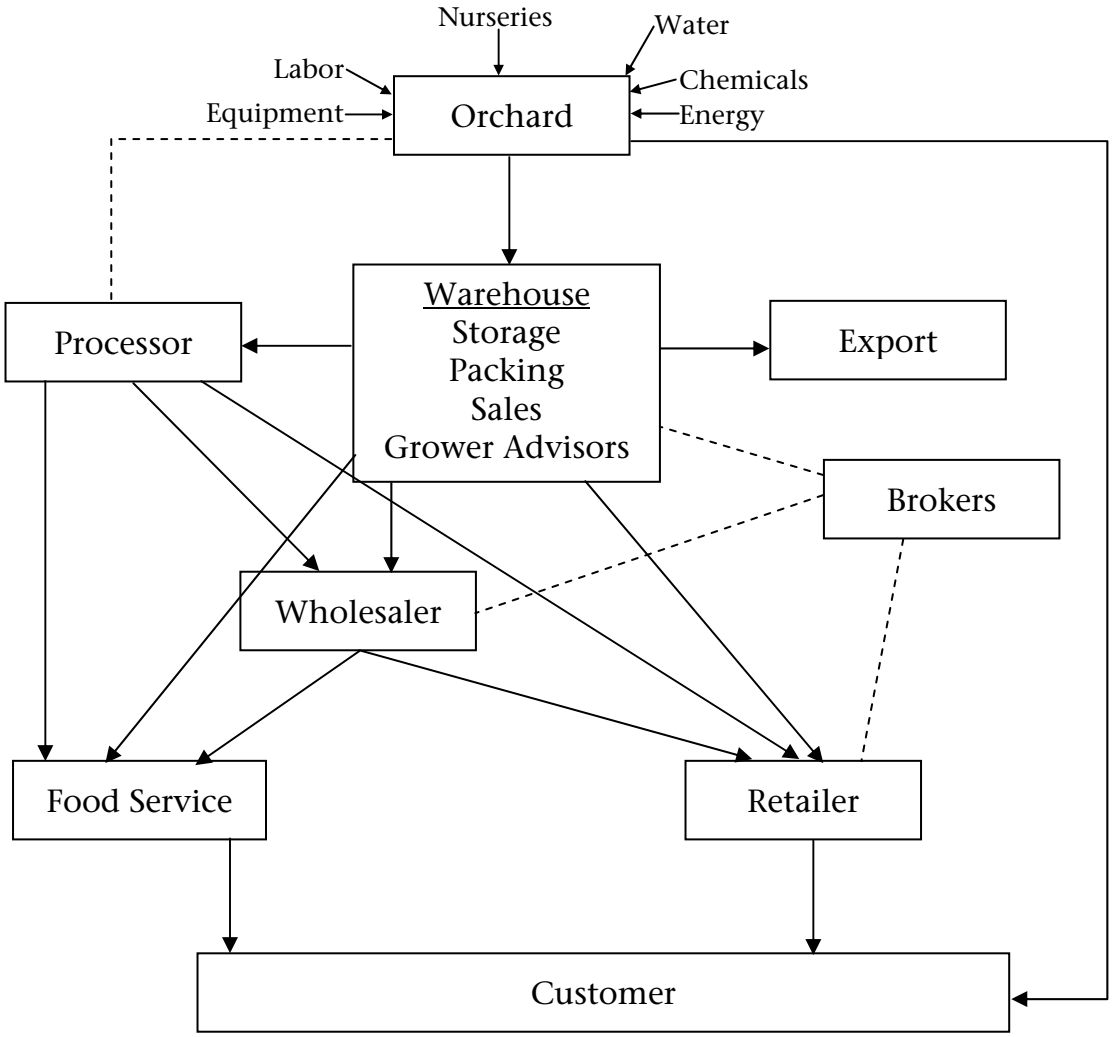
As a management paradigm supply chain management (or, as some people, prefer demand chain management) is a relatively new construct. In its essence, the idea is to have the most efficient supply chain. The evolution of food retailers in this direction appears to have been hampered by some traditional industry practices which have become very important financially. Because WalMart has not been involved in food retailing very long they have not developed those traditions (constraints). Since these traditions have become integral parts of the corporate system/culture making changes is difficult and slow.

Figure 16 shows the flow of product from the orchard to the consumer, in effect, the supply chain for apples. Fruit are produced and harvested in the orchard and then delivered to the warehouse for storage and packing. Most types of inputs are identified. Although not listed, management is a critical element.

The dotted line connecting the orchard to the processor is included to account for the apples that have been damaged during the growing season and do not meet fresh market standards. For example, apples damaged by hail (hail can cause serious indentations in the fruit which causes them to be classed as culls) are sometimes sold directly to the processor.

The solid line from the orchard to the consumer represents direct sales through roadside stands, farmer's markets, etc. Relative to the amount of apples produced in Washington direct sales to consumers are insignificant, but very important to those growers who have cultivated this market niche.

Figure 16: Apple Production and Marketing System



In the Washington apple industry warehouses sell a set of services to growers. Warehouses do not typically buy the fruit, but merely supply a set of services. The major services are listed in the chart. The storage category includes both regular atmosphere and controlled atmosphere storage. Packing includes grading, sizing and placing fruit in cartons.

Sales may be handled by warehouse employees or they may be handled by a sales agency. Sales agencies can technically be brokers, but the term “broker” generates a very strong emotional response among some people in the industry and most people try to avoid using the term.

Most sales are made on an FOB basis and usually use Washington grade standards which are slightly higher than U.S. standards. FOB means “Free on Board” and is used to indicate part of the terms of the sale. If a sale is made FOB, it means that the costs of packing, storage and loading the truck or container are included in the price, while transportation to the buyer’s receiving facility is not included in the price.

Grade standards were originally established to facilitate communication between buyers and sellers who were physically separated by significant distance which precluded the buyer from actually checking the fruit or vegetable before negotiating its purchase. These standards cover size, shape, insect and disease damage and bruises. Color is also a factor of grade for the “red” apples. Minimum container weight was also included.

Because of the increasingly sophisticated color sorting equipment available today, many warehouses actually have two or three categories in the Washington extra fancy grade to differentiate the amount of red color on the apples. It has predominantly been used for Red Delicious, but this practice is now also applied to Gala and Fuji. In Red Delicious the top or premium label is used with fruit that have 90 to 100% red color. The second label is used with fruit that have 80+ % red color and the third label is used for fruit that have 2/3’s or better red color. This breakdown by color above the minimum required for the extra fancy grade is not governed by any legal standards, so each warehouse has the option of establishing its own standards.

In order to ensure that neither the buyer nor the seller could make false claims, a third party inspection service, the Federal-State Inspection Service, was established. The service inspects randomly selected cartons at shipping point to make sure that the information stamped on the carton (grade, size, etc.) properly describes the fruit within and checks box weight. Inspectors are also stationed at receiving point to double-check shipments that the buyer may think is out of grade.

If a shipment is out of grade, the buyer has the option of rejecting the load or renegotiating price. If the shipment is rejected by the buyer it is the shipper’s responsibility to find another buyer or dispose of the shipment. Returning the shipment to the warehouse is not normally an option because of Washington’s distance from the major markets.

One option sometimes used is to deliver the shipment to a repacker who then opens each carton, disposes the problem fruit, repacks the cartons and sells the fruit. Any money remaining after covering the cost of repacking is remitted to the shipper.

Sometimes, when supplies are really burdensome, warehouses will ship “on consignment”. These shipments are sent to a receiver who sells them at whatever price people are willing to pay. Again, after deducting the costs of selling, the remainder is remitted to the shipper. Shipping on consignment is not a preferred practice.

Some warehouses employ fieldmen to advise on various aspects of fruit production. One common service is advice on the control of insects. Some warehouses offer horticultural advice. Time of harvest is also often suggested/mandated by warehouse fieldmen. The willingness of growers to accept advice on timing of harvest is somewhat complicated as it is a function of the type of warehouse (private or co-op), the manner in which grower payments are calculated, and the size/maturity of the fruit. More about this later.

Sales of fruit are made to retailers, wholesalers and food service firms. Information on the actual distribution by type of buyer is limited, but it appears that most fruit go directly to retailers. Anecdotal information indicates that less than 25% of the volume goes to food service. Wholesalers can be broken into two groups, those who service small local retail chains and stores, and the wholesale markets that exist in the major

markets. Broadline wholesalers, like Sysco, attempt to offer everything a retailer stocks from dry goods to frozen products to produce. These firms deliver to both food retailers and food service.

Vendors in wholesale markets such as Hunt's Point in New York City tend to specialize in produce and often only in selected produce items. With the continued merging of retail firms and the shift to direct buying from shippers, firms at these wholesale markets are losing market share.

Apple Production and Economics

Growing apples is complicated by the decisions that have to be made before the trees are planted, the decisions that have to be made while the trees are still young and nonbearing, and by the decisions made during each of the producing years.

In the establishment of an orchard the grower has to decide which variety or varieties to plant. This is a 15 to 20 year decision. The trees will continue to be productive longer than that, but in that period of time new strains will have been propagated that have more desirable fruit characteristics (as in more profitable). These new, improved characteristics reduce the value of the production from the older plantings. The newest strains of Red Delicious, for example, can produce fruit 90% of which are in the Washington extra fancy grade. This causes the price for fruit in this grade category to decline, without increasing prices for the lower grades. Growers with the newest strains can still break even because a large proportion of their fruit is in the highest grade. However, growers with older strains now become unprofitable because those older blocks just don't have enough highly colored fruit.

In addition to the selection of variety, the grower must decide on the size of tree. The size of the tree affects the length of time it takes to get into production and the amount of time spent training in the early years as well as the amount of time required for pruning, thinning and harvesting after the trees begin producing fruit. The length of time to get into production is important given today's cost of establishment. Each extra year without production can add as much as $1000 per acre to the cost of establishment in the form of accumulated interest on the investment.

After the trees are planted, irrigation systems are installed and support structures may be built. The need for a support structure is determined by the variety, the rootstock and training system chosen. In parts of the Columbia Basin the soils are so sandy that support systems are needed to ensure the trees can withstand the winds that sometimes occur.

Tree training is done to improve the penetration of light into the interior of the tree and to enhance the growth of the parts of the tree where the fruit are produced. The more diligently these activities are undertaken, the greater the likelihood of higher yields of highly marketable fruit.

The costs of production can be calculated a couple of ways. Washington State University extension faculty has generated cost estimates for many years. In the early years cost budgets were based on the actual cost of production. These budgets were developed from data gathered directly from producers. As this method became more expensive to produce the committee approach was developed. In the committee approach

a group of growers (usually above average producers) was brought together and asked to identify all of the activities associated with establishing an orchard or producing a crop. The time required and the equipment used are also determined. Given this set of information, the faculty builds an estimate of the cost of production. All fixed costs such as real estate taxes, the amortized establishment cost, the return on the investment in land and buildings, and accounting services are included. These cost estimates or enterprise budgets represent the costs to produce an acre of crop using normal production practices and may not reflect the actual cost in any given year. The W.S.U. enterprise budgets are better used as an indicator of the costs that need to be covered annually, on average, over the life of the orchard.

Mr. Jim DuBruille at Wenatchee Valley College has produced a set of estimates of production costs, using information gathered from records of growers with whom he has worked in north central Washington. These are averages of actual costs. The growers from whom this information was gathered are considered to be small operators. Hence, these estimates may be a reasonable upper bound on the range of production costs that can be found in the industry.

Before going any further, a caveat is in order for two reasons. First, with the exception of equipment and overhead there may not be much difference between a small and a large operation. Further, the resourceful small grower may be able to keep costs at levels similar to the larger operation.

Second, it is not intuitively obvious that the low cost grower is as profitable as a grower with higher expenses. Growers may be able to reduce costs by not pruning as diligently as necessary and by not thinning as hard (removing fewer apples from the tree). However, in both cases, there is a negative impact on the value of the fruit through reduced size and lower grade (less sunlight in the interior of the tree). In addition, production in later years may be reduced as well because of the loss of new growth where most apples are produced. Hence, better growers may have higher production costs because of the greater emphasis on activities that affect grades, size and yield.

In this report both types of budgets will be used to help the reader better understand complexities of apple production as well as the costs incurred by growers. The most recent W.S.U. enterprise budget will provide the details on the activities carried out during a growing season and the cost data compiled by DuBruille will be included to show recent costs of production.

Table 4 is the schedule of operations and estimated costs per acre for a mature high density Fuji block in Washington.[19] The orchard is assumed to have 100 acres, of which 10 acres have recently been planted with Fuji trees and have now reached full production. The first column identifies all of the operations that have been carried out during the growing season, beginning with pruning during the dormant season (winter) and ending with a final application of herbicide after harvest in October or November.

The second column indicates the equipment used in each operation or, in some cases, the number of people normally used to carry out the activity. The next columnar

[19] Tables 4 and 5 were taken from the most recent W.S.U. budget which can be found at http://farm.mngt.wsu.edu/PDF-docs/EB1878.pdf

entry is the month the activity occurs. Some activities occur throughout the season and are indicated by “sea”.

This table allows the reader to see total costs, the amount of labor and machine time needed per acre, and the most expensive activities as well as the inputs that represent the largest shares of the total cost. Labor is the single most important expense in growing Fuji apples. This is due to the high cost of harvest. The skin on Fuji apples is easily punctured; hence, it is necessary to clip the stems to avoid puncture wounds which cause the apples to be placed in the cull bin. Note that the cost of picking is treated as a service entry rather than in the labor cost column.

The second largest expense is the amortized establishment cost. In 1998, the cost to establish an acre of high density Fuji orchard was about $14,000. In the fifth year (the trees are four years old) there is sufficient revenue generated to cover the costs of production and begin to pay off the debt incurred during the establishment period. The amortized establishment cost is based on $12,777 of debt per acre. The payback is based on 15 years and 9% interest.

Other information can be gleaned from this table. For example, the number of trees per acre is assumed to be 745. When mature, the growers involved in building this table estimated that it would take 32.5 hours per ac to remove excess fruit (thin). This works out to be about 3 minutes per tree. Keep in mind, however, that these are small trees and ladders may not be needed.

Table 5 contains a list of the itemized inputs used to produce an acre of Fuji apples. It contains the same information as Table 4, but is organized by input rather than activity. The variable costs listed here essentially represent the cash costs that the grower must cover, assuming the planting was self-financed. Nearly 60% of the grower’s cash cost is labor. If the grower borrowed to finance the planting of the new block, his total cash outlay increases from $3000 to about $4300. At 35 bins per acre the difference is over $37 per bin.

Labor costs are $50 per bin. Labor and debt service together represent a cost of $86 per bin, or, at 16 packs per bin, $5.38 per carton. The total growing and harvesting cost based on this budget per carton (using the 16 cartons per bin) is $10.28. Assuming warehousing costs of $7.50, an FOB average price of $17.78 is needed to break even. The estimated average FOB for 2001 was $17.14. Based on the earlier assumptions about yield and packout, that FOB gave the grower a net profit after all expenses of -$358.40 per acre. If you add up the return on the

Table 4: Schedule of Operations and Estimated Costs per Acre for Establishing a High Density Apple Orchard in Eastern Washington - Year 5.

OPERATION	TOOLING	MTH	YEAR	MACH HOURS	LABOR HOURS	TOTAL FIXED COST	VARIABLE COST				TOTAL VARIABLE COST	TOTAL COST
							FUEL, LUBE, & REPAIRS	LABOR	SERVICE	MATER.	INTER.		
						$	$	$	$	$	$	$	$
PRUNE	HAND LABOR (2 PEOPLE)	FEB	2002	.00	30.00	2.76	.00	225.00	.00	.00	13.50	238.50	241.26
DORM. SPY + ZINC	52HP-WT, BLAST SPRAYER	MAR	2002	.50	.60	8.38	4.78	5.25	.00	16.31	1.38	27.72	36.10
MILDEW/BORON SPY	52HP-WT, BLAST SPRAYER	APR	2002	.50	.60	8.38	4.78	5.25	.00	11.66	.98	22.66	31.04
MILDEW SPRAY	52HP-WT, BLAST SPRAYER	APR	2002	.50	.60	8.38	4.78	5.25	.00	3.38	.60	14.01	22.39
COVER SPRAY	52HP-WT, BLAST SPRAYER	APR	2002	.50	.60	8.38	4.78	5.25	.00	16.34	1.19	27.56	35.94
THINNING SPRAY	52HP-WT, BLAST SPRAYER	APR	2002	.50	.60	8.38	4.78	5.25	.00	66.30	3.43	79.77	88.15
RENT BEEHIVE	TWO BEEHIVES PER ACRE	APR	2002	.00	.00	.00	.00	.00	70.00	.00	3.15	73.15	73.15
FROST CONTROL	WIND MACHINE	APR	2002	.00	2.00	152.11	92.79	17.50	.00	.00	4.96	115.25	267.36
FROST CONTROL	FROST ALARM & THERMOMETERS	APR	2002	.00	.00	2.97	.00	.00	.00	.00	.00	.00	2.97
FROST CONTROL	UNDERTREE SPRINKLERS	APR	2002	.00	.00	74.90	10.00	.00	18.75	.00	1.29	30.04	104.94
IRRIGATE	SOLID SET UNDERTREE IRR SYSTEM	SEA	2002	.00	.00	203.03	50.00	.00	150.00	.00	9.00	209.00	412.03
IRRIGATE	4-WHEEL ATV W/ABOVE OPERATION	SEA	2002	10.00	10.00	21.94	10.08	87.50	.00	.00	4.39	101.97	123.90
FERTIGATE	THROUGH THE IRRIGATION SYSTEM	SEA	2002	.00	1.00	.00	.00	8.75	.00	18.00	1.20	27.95	27.95
CALCIUM SPY (4X)	52HP-WT, BLAST SPRAYER	SEA	2002	2.00	2.40	33.52	19.12	21.00	.00	6.19	2.08	48.40	81.92
MOW	52HP-WT, 9' ROTARY MOWER	MAY	2002	.50	.55	4.95	2.74	4.81	.00	.00	.28	7.83	12.78
COVER SPRAY	52HP-WT, BLAST SPRAYER	MAY	2002	.50	.60	8.38	4.78	5.25	.00	16.34	.99	27.36	35.74
COVER SPRAY	52HP-WT, BLAST SPRAYER	MAY	2002	.50	.60	8.38	4.78	5.25	.00	7.22	.65	17.90	26.28
MILDEW SPRAY	52HP-WT, BLAST SPRAYER	MAY	2002	.50	.60	8.38	4.78	5.25	.00	3.38	.50	13.91	22.29
THINNING SPRAY	52HP-WT, BLAST SPRAYER	MAY	2002	.50	.60	8.38	4.78	5.25	.00	5.83	.59	16.46	24.84
MOW	52HP-WT, 9' ROTARY MOWER	JUN	2002	.50	.55	4.95	2.74	4.81	.00	.00	.23	7.78	12.72
HERBICIDE	52HP-WT, 100 GAL SPRAYER	JUN	2002	.40	.48	4.50	6.32	4.20	.00	11.91	.67	23.11	27.61
THINNING SPRAY	52HP-WT, BLAST SPRAYER	JUN	2002	.50	.60	8.38	4.78	5.25	.00	10.06	.60	20.69	29.07
COVER SPRAY	52HP-WT, BLAST SPRAYER	JUN	2002	.50	.60	8.38	4.78	5.25	.00	7.22	.52	17.77	26.15
THINNING SPRAY	52HP-WT, BLAST SPRAYER	JUN	2002	.50	.60	8.38	4.78	5.25	.00	36.73	1.40	48.17	56.55
HAND THINNING	HAND LABOR	JUN	2002	.00	32.50	.00	.00	243.75	.00	.00	7.31	251.06	251.06
MOW	52HP-WT, 9' ROTARY MOWER	JUL	2002	.50	.55	4.95	2.74	4.81	.00	.00	.17	7.72	12.67
COVER SPRAY	52HP-WT, BLAST SPRAYER	JUL	2002	.50	.60	8.38	4.78	5.25	.00	7.22	.39	17.64	26.02
COVER SPRAY	52HP-WT, BLAST SPRAYER	JUL	2002	.50	.60	8.38	4.78	5.25	.00	12.85	.51	23.40	31.78
MOW	52HP-WT, 9' ROTARY MOWER	AUG	2002	.50	.55	4.95	2.74	4.81	.00	.00	.11	7.66	12.61
HERBICIDE	52HP-WT, 100 GAL SPRAYER	AUG	2002	.40	.48	4.50	6.32	4.20	.00	11.91	.34	22.77	27.27
MOW	52HP-WT, 9' ROTARY MOWER	OCT	2002	.50	.55	4.95	2.74	4.81	.00	.00	.00	7.55	12.50
HARVEST(35 BINS)	PICKERS (10 PEOPLE)	OCT	2002	.00	.00	9.29	.00	.00	787.50	.00	.00	787.50	796.79
HARVEST	52HP-WT, BACKFORK	OCT	2002	7.00	7.70	45.60	24.11	67.37	.00	.00	.00	91.49	137.09
CHECK BINS	CHECKER FOR PICKING CREW	OCT	2002	.00	7.00	.00	.00	52.50	.00	.00	.00	52.50	52.50
BIN HANDLING	52HP-WT, BIN TRAILER	OCT	2002	3.50	3.85	27.49	14.59	33.69	.00	.00	.00	48.28	75.77
LOAD FRUIT	52HP-WT, FORKLIFT	OCT	2002	1.40	1.54	14.60	8.60	13.47	.00	.00	.00	22.08	36.68
HAUL FRUIT	CUSTOM HAULING	OCT	2002	.00	.00	.00	.00	.00	105.00	.00	.00	105.00	105.00
HERBICIDE	52HP-WT, 100 GAL SPRAYER	OCT	2002	.40	.48	4.50	6.32	4.20	.00	42.16	.00	52.68	57.18
GOPHER CONTROL	HAND LABOR	ANN	2002	.00	2.00	.00	.00	15.00	.00	1.28	.73	17.01	17.01
MISC USE	½ TON PICKUP	ANN	2002	7.14	7.85	36.45	23.42	68.69	.00	.00	4.14	96.25	132.70

TABLE 4 - SCHEDULE OF OPERATIONS AND ESTIMATED COSTS PER ACRE FOR ESTABLISHING A HIGH DENSITY APPLE ORCHARD IN EASTERN WASHINGTON - YEAR 5 (CONTINUED).

						VARIABLE COST						
OPERATION	TOOLING	MTH YEAR	MACH HOURS	LABOR HOURS	TOTAL FIXED COST	FUEL, LUBE, & REPAIRS	LABOR	SERVICE	MATER.	INTER.	TOTAL VARIABLE COST	TOTAL COST
					$	$	$	$	$	$	$	$
MISC USE	4-WHEEL ALL TERRAIN VEHICLE	ANN 2002	5.70	.00	12.50	5.74	.00	.00	.00	.26	6.00	18.51
MISC USE	MACHINE SHED & SHOP	ANN 2002	.00	.00	38.71	.71	.00	.00	.00	.03	.75	39.46
MISC USE	SHOP TOOLS	ANN 2002	.00	.00	15.29	.00	.00	.00	.00	.00	.00	15.29
OVERHEAD	UTILITIES, LEGAL, ACCTNG, ETC.	ANN 2002	.00	.00	.00	.00	.00	141.71	.00	.00	141.71	141.71
MANAGEMENT	OPERATOR MANAGEMENT	ANN 2002	.00	.00	250.00	.00	.00	.00	.00	.00	.00	250.00
LAND COST	INTEREST ON LAND	ANN 2002	.00	.00	350.00	.00	.00	.00	.00	.00	.00	350.00
TAXES	LAND	ANN 2002	.00	.00	72.05	.00	.00	.00	.00	.00	.00	72.05
INTEREST COST	INTEREST ON ESTABLISHMENT COST	ANN 2002	.00	.00	1261.80	.00	.00	.00	.00	.00	.00	1261.80
TOTAL PER ACRE			47.44	120.43	2780.57	358.76	964.39	1272.96	312.28	67.61	2976.00	5756.57

Table 5: Itemized Cost per Acre for Establishing a High Density Apple Orchard in Eastern Washington - Year 5.

	UNIT	PRICE OR COST/UNIT	QUANTITY	VALUE OR COST	YOUR FARM
VARIABLE COSTS		$		$	
UREA	LB.	.18	100.00	18.00	
CALCIUM CHLORIDE	LB.	.43	14.40	6.19	
SUPERIOR OIL	GAL.	2.60	2.70	7.02	
ZINC 50	LB.	1.29	7.20	9.29	
WILTHIN	QT.	11.61	5.40	58.05	
RALLY	OZ.	4.70	2.25	10.58	
SOLUBOR	LB.	.80	1.35	1.08	
WETABLE SULFUR	LB.	.75	9.00	6.76	
DIPEL	LB.	9.08	3.60	32.68	
GUTHION	LB.	8.02	2.70	21.65	
CARBARYL 4L	PT.	3.24	3.60	11.66	
REGULAID	PT.	2.75	5.00	13.75	
ROUNDUP	QT.	11.91	2.00	23.82	
NAA 200	OZ.	.82	1.80	1.48	
ETHREL	PT.	5.00	1.80	9.00	
AMID-THINW	OZ.	3.47	7.20	24.98	
PROVADO	OZ.	3.57	3.60	12.85	
SURFLAN	QT.	16.60	2.00	33.20	
PRINCEP	QT.	4.48	2.00	8.96	
GOPHER GETTER	LB.	1.28	1.00	1.28	
RENT BEEHIVES	HIVE	35.00	2.00	70.00	
CASUAL LABOR	HOUR	7.50	71.50	536.25	
LABOR(TRAC/MACH)	HOUR	8.75	48.93	428.14	
PICKING LABOR	BIN	22.50	35.00	787.50	
CUSTOM HAULING	BIN	3.00	35.00	105.00	
IRR CHARGE & ELECT	ACRE	168.75	1.00	168.75	
TRACTOR REPAIR	ACRE	36.90	1.00	36.90	
TRACTOR FUEL/LUBE	ACRE	44.56	1.00	44.56	
MACHINERY REPAIRS	ACRE	186.52	1.00	186.52	
MACHINE FUEL/LUBE	ACRE	90.78	1.00	90.78	
OVERHEAD	ACRE	141.71	1.00	141.71	
INTEREST ON OP. CAP.	ACRE	67.61	1.00	67.61	
TOTAL VARIABLE COST				2976.00	
FIXED COSTS		$		$	
TRACTOR DEPRECIATION	ACRE	65.60	1.00	65.60	
TRACTOR INTEREST	ACRE	71.96	1.00	71.96	
TRACTOR INSURANCE	ACRE	4.80	1.00	4.80	
TRACTOR TAXES	ACRE	14.39	1.00	14.39	
MACHINE DEPRECIATION*	ACRE	301.43	1.00	301.43	
MACHINE INTEREST*	ACRE	315.10	1.00	315.10	
MACHINE INSURANCE*	ACRE	20.95	1.00	20.95	
MACHINE TAXES*	ACRE	52.49	1.00	52.49	
LAND TAXES	ACRE	72.05	1.00	72.05	
LAND COST	ACRE	350.00	1.00	350.00	
MANAGEMENT	ACRE	250.00	1.00	250.00	
INTEREST ON ESTAB.	ACRE	1261.80	1.00	1261.80	
TOTAL FIXED COST				2780.57	
TOTAL COST				5756.57	

*INCLUDES MACHINE SHED & SHOP, WIND MACHINE AND IRRIGATION SYSTEM.

investment in land that is assessed in the budget and a charge for management, the grower received about $240 per acre for his efforts and investment.

However, the 2000 Fuji price averaged $12.75. This low price resulted in a loss per carton of $5.03 or about $2800 per acre. For the whole block the grower suffered a $28,000 loss. That loss is based on total cost. Thinking about it in terms of what the grower does receive, the return is $5.25 per carton or $2940 per acre.

The average price for the 2000 crop was not enough, in this example, for the grower to even cover cash costs. In addition to the $2976, taxes must also be covered plus any payments due on the establishment costs.

These numbers help to point out the difference between a small 50 or 100 acre orchardist who is financed by the local bank branch under strict contractual conditions and the large investment group that has a longer term perspective. After a year or two of being unable to make principal payments, the bank is less inclined to be supportive unless the small grower has some other collateral to offer. The investment group is more inclined to look at the longer term potential and discount short-term returns.

A few words about the materials listed in Table 5 are needed. Those materials include fertilizers, insecticides, herbicides, thinning agents and growth regulators. In addition there is material that is used injunction with the pesticides to achieve more even application that allows the grower to actually use less active ingredient. The grower may not use all of those materials as use is determined by the level of incidence of insects, disease and weeds.

Over time the materials that can be used in the orchard have changed as more is learned about the materials and the insects in the orchard as well as the causes of the most common diseases. The cause of change in materials is the loss of efficacy. Over time tolerance builds in the target population and new materials are needed to achieve adequate control.

In addition, more is now known about the different roles of insects within the orchard. Some are detrimental to the fruit, but others are beneficial through their predation on harmful insects. As a result of this knowledge new materials have become more insect specific.

Growers have also shifted to greater use of pheromone traps. These pheromones disrupt the mating cycle and help to keep the adult population in check. This results in the reduced use of control materials.

The industry has been using integrated pest management methods for 30 years. Originally, the program used monitoring of insects to determine if and when to spray. This helped growers reduce the amount of materials that needed to be applied. As long as the population was low the economic damage from the insects did not warrant applying control measures.

For some insects, strict control is very important. Codling moth is an example. Some countries have a zero tolerance for this insect, Taiwan is one example, and the finding of an insect or larva in the fruit will cause a loss of market access. In the fall of 2002, in fact, one larva was found in an apple in a shipment that had arrived in Taipei,

Taiwan. That market was closed to further shipments of Washington apples. Since Taiwan buys 3 to 4 million cartons each year, this closure was significant. The market has again been reopened, but only after a new inspection protocol had been established to ensure this did not happen again.

The use of control materials in the orchard is not well understood by many people outside the industry. The loss of efficacy of a material over time means that chemical companies have to continually develop new replacement materials. The newer materials are becoming more pest specific, and more expensive for the grower. The economic incentive to the grower to minimize use is increasing.

In addition, the increasing costs of developing new materials and getting them certified by the federal government causes chemical firms to become less willing to work on the needs of crops with only limited acres. (Consider the 173,000 acres of apples in Washington versus the millions of acres of wheat in this state.)

Each year Cooperative Extension publishes a guide to the appropriate materials to be used in fruit production, the timing of application and the rates at which they should be applied. A full copy of that publication is available at http://cru.cahe.wsu.edu/CEPublications/eb0419/eb0419.pdf. This publication is revised each year and only the most recent edition is completely accurate due to changes in availability and certification of materials.

Table 6 contains actual average cost data from a sampling of growers in north central Washington. In each case the orchard is assumed to be 45 acres in size. The Reds, Goldens and Fuji estimates are based on 2000 crop expenses. The Gala and Granny Smith estimates were generated using 2001 cost data. Several factors cause the estimates to deviate from each other. Yield is one such factor. The higher the yield, the greater the labor cost. The manner in which harvest is conducted also affects labor costs. Fuji's are more expensive to harvest as the stems need to be clipped to eliminate stem punctures. Gala harvest costs are higher because this variety cannot be harvested with one pass through the orchard. Color is very important and only those fruit with sufficient color have reasonable market value. Hence, growers have the pickers harvest only the highly colored fruit and then return to that block later to harvest the rest of the fruit.

The other major factors are depreciation and interest. The Fuji's and Gala's are younger trees and have more trees per acre. This results in a higher depreciation charge as well as a higher interest charge.

The size of DuBruille 's orchard is large enough to keep the grower busy full time. The operator's labor charge is a charge for the grower's time spent working in the orchard. This is not a substitute for the management charge in the W.S.U. budget which is added to cover the grower's management time. The DuBruille budgets do not have a charge for management time.

Table 6: Recent average cost data.*

	Reds	Goldens	Fuji	Granny Smith	Gala
Variable Costs					
Labor	1570	1760	1815	1760	2010
Chemicals	380	380	380	380	380
Operator labor	285	285	285	333	333
Other	275	275	275	275	275
Total	**2510**	**2700**	**2755**	**2748**	**2998**
Ownership Costs					
Depreciation	490	490	775	490	777
Interest	770	770	1055	770	1055
Taxes & Ins.	150	150	210	150	210
Total	**1410**	**1410**	**2040**	**1410**	**2042**
Total Cost per Ac	**3920**	**4110**	**4795**	**4158**	**5040**
Yield (bins)	40	50	35	50	40
Cullage	22%	27%	27%	16%	18%
Breakeven FOB	13.23	13.09	16.68	12.45	15.11

**Cost calculated by Mr. Jim DuBruille, Wenatchee Valley College.*

The breakeven FOB shown at the bottom of the table for each variety includes an estimate of the packing charges assessed by the warehouse. These estimates will be used later in the report when discussing season average prices.

The variable costs do vary from year to year according to yields, insect and disease pressures and changing input prices. Ownership costs are more stable as they pertain, for the most part, to the initial investment made in planting the orchard block.

One of the things that growers do to keep costs down is use equipment for long periods of time. A survey done a number of years ago of wheat growers found that the average age of the wheel tractors used in eastern Washington was 18.8 years and crawler tractors averaged 27 years of age.[20] A survey of apple growers would probably find that much of the equipment was completely depreciated.

Labor

Since apple production is such a labor intensive activity, a closer look at labor needs within the industry is warranted. The earliest commercial orchards were small compared to today's operations. A cost study of apple production in 1914 reported the average size of orchard in the study area (the greater Wenatchee area) to be 6.5 acres.[21] The 2002 agricultural census indicates that the average orchard has 44.6 ac. In those early days, all of the labor, except harvest labor, was often supplied by the household. That pattern held for many years. Mechanization and the development of dwarfing rootstocks which keep the trees from growing very big have helped to reduce the amount of labor needed per acre of orchard.

[20] Barron, J.C., Lee Blakeslie and Gayle Willett. Grain Farms in Eastern Washington: An Economic Assessment. XB1022, College of Agriculture and Home Economic Research Center, Pullman, WA, 1991, p. 20.

[21] Miller, G.H. and S.M. Thomson. The Cost of Producing Apples in Wenatchee Valley Washington. USDA Bulletin No. 446. Washington, D.C. Government Printing Office. January 1917.

Table 7 contains selected information taken from cost studies conducted over the past 88 years. The decline in the need for labor can be seen in the number of hours required to produce an acre of apples. Reducing the size of the tree has had a major impact on the number of needed hours and this has occurred only in the past 30 years. No other major change has occurred since the introduction of the orchard sprayers 60-70 years ago. Prior to that time workers would go through the orchards with large hoses attached to a centralized system of pipes and spray the trees. The development of tractor drawn and self-propelled sprayers reduced the labor requirements to one person to operate the tractor.

Table 7: Historical production data.

Year	Variety	Trees per Acre	Total Cost	Total Variable Cost	Total Fixed Cost	Growing Labor	Harvest Labor	Growing Labor	Harvest Labor	Yield Bins
		Per Acre								
			$	$	$	$	$	Hrs	Hrs	
1914								227.6	153.32	0
1915								201.2	142.6	0
1917		17	290.64	103.71	186.93	57.22	43.5	230.01	174	
1927								242.6	116.9	0
1932*								224.7	102.5	
1939			179.49	149.65	29.84	72.49	51.74	279	155	0
1940			174.58	144.38	30.2	69.66	53.17	268	197	0
1941			202.16	170.57	31.59	73.91	61.42	200	165	0
1942			285.15	241.19	43.96	132.16	94.99	259	178	0
1943			362.17	296.47	65.7	188.29	105.21	251	129	0
1950								149	106	0
1953			697.95	481.15	216.8	172.23	135.55	144	92	0
1954			764.97	513.77	251.2	199.42	147.83			0
1955			760.36	503.87	256.49	195.93	146.09			0
1956			764.51	503.8	260.71	165.49	133.16			0
1958			989.11	602.2	386.91	221.25	175.76			0
1960			825.57	467.68	357.89	159.09	101.3	120.9	55.7	0
1962		52	849.25	626.25	223	213.01		112.62		0
1965			750.37	393.21	357.16	130.9	98.71	87.26	65.8	0
1977	Reds	217	2359.28	1210.61	1148.67	333.02	431.75	89	98	49
1982	Reds	269	3732.99	2343.42	1389.57	772.69	634	122.69	101	60
1985	Reds	295	4909.87	2927.76	1982.11	859.32	533	165.18	111	54
1987	Reds	218	4108.64	2259.06	1849.58	857.34	369	155.88	67	30
1991	Fuji	745	3942.05	3147.59	794.46	1102.43	825	146.9	136	55
1992	Reds	218	4241.23	2324.78	1916.45	983.5	460	92	80	40

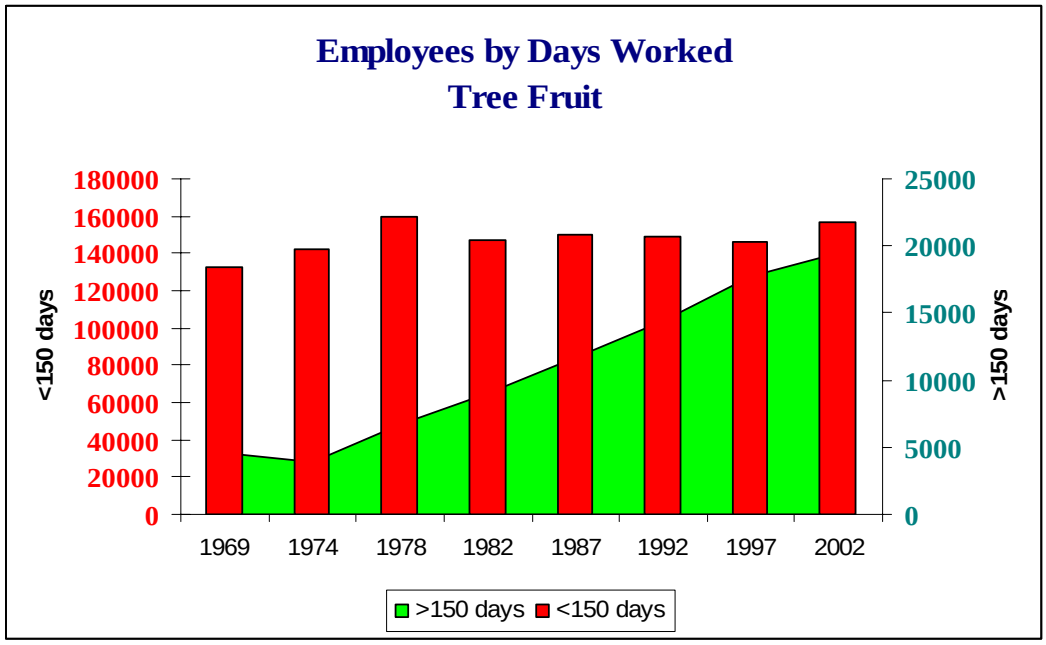
** Average of 1926, 1927, and 1928. Data were only for horse operated orchard and didn't include orchards using tractors. Wenatchee area only.*

The other factor that is having a major impact on worker numbers is the trend to diversification. As noted earlier, when the industry was producing predominantly Red Delicious, the harvest period was condensed into a few short weeks. Today, as growers diversify into other varieties the harvest season is being lengthened from those few weeks into months. The result is that growers are able to use fewer pickers, but for a much longer time. The Agricultural Census contains data that are starting to show the effects of this diversification. Figure 17 shows the number of people reported as working less than and more than 150 days for fruit producers. In this figure the bars are associated with the left vertical axis and the line is associated with the right axis. It is highly likely that the number of people actually employed less than 150 days, as reported here, is significantly inflated as the Bureau of the Census did not attempt to determine the actual number of people employed for short periods of time. In fact, these numbers might better be considered as the number of short term employment opportunities in apple production. The more important point for this discussion is the trend in the numbers.

With the addition of employee numbers data from the 2002 census the historical trends as argued here are not quite so clear. While longer term employment numbers continue to increase, the number of short-term employees also increased while total orchard acreage is reported to have declined. It is possible that there has been an increase in short-term employment since sweet cherry acreage has increased significantly and that means more people will be needed for harvest. However, adjustments in coverage of this census appear to have impacted the numbers significantly, raising a question of comparability with earlier years.

Because labor costs continue to be one of the biggest grower expenses, and certainly the most important cash cost, there is a major effort within the industry to reduce these costs. Currently there is a major initiative under the auspices of the Washington Tree Fruit Research Commission to reduce costs by 30% by increasing the use of new technologies. Given labor's prominence in the budget a significant part of the effort is to adapt new technologies to replace labor. A copy of the defining document is available at http://www.treefruitresearch.com/techroad.htm, select *Technology Roadmap Version 9.3*. While the industry will find ways to reduce the number of hours needed to produce and harvest apples, it will need more highly skilled employees to operate the new equipment. So, while there will be fewer people working in orchards, those remaining will likely be earning higher wages.

Figure 17: Number of orchard employees by number of days worked.

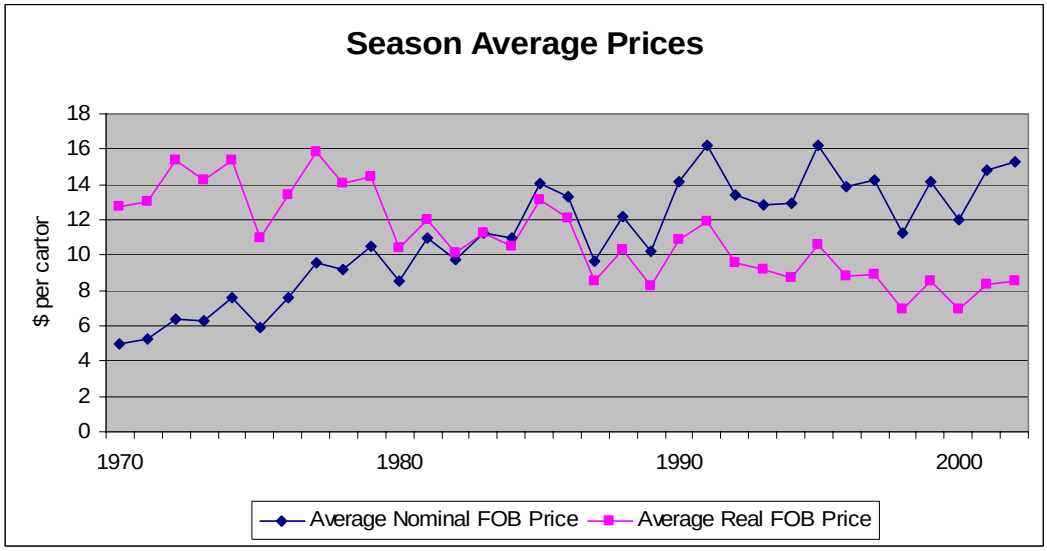


Source: Census of Agriculture, various years.

PRICES AND RETURNS

Over time apple prices have been increasing in nominal terms. However, when adjusted for inflation (real terms) the trend is decidedly downward. Figure 18 shows both patterns. The declining real prices are a good indicator of the pressures faced by growers to reduce costs and increase yields.

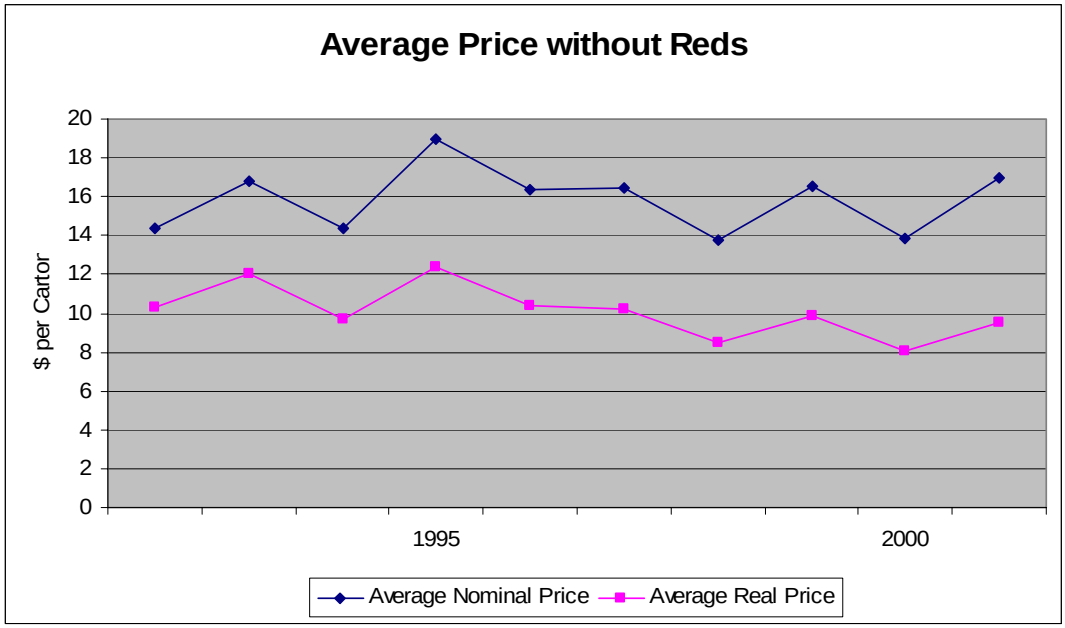
Figure 18: Seasonal real and nominal prices.



Source: Washington Growers Clearing House.

The price pressures faced by growers are not just a function of Red Delicious. Real prices in general are slipping. Figure 19 shows nominal and real season average prices without Red Delicious. In this case both sets of prices appear to be falling over time. The decline in nominal prices is a result of the growth in production of these newer varieties. The varieties included in Figure 19 include Golden Delicious, Granny Smith, Gala, Fuji, Braeburn and Jonagold.

Figure 19: Average prices without Reds.

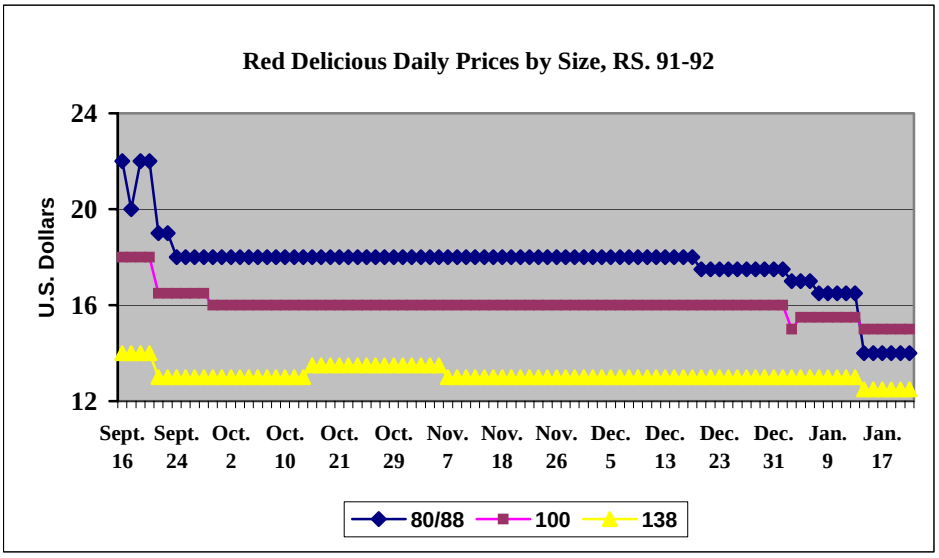


Source: Ibid.

Within season patterns have changed over time. Historically, prices started out high as the new crop began to enter the market and then fell as volume increased. Late in the season prices began to improve as supplies dwindled. Figures 20 and 21 show the seasonal price pattern. Each chart contains the daily midpoint Washington Extra Fancy price as reported by the USDA's Market News Service. Three size categories are shown to provide an indication of the effects that fruit size has on price. In the regular storage chart (RS) prices begin high and then fall as supplies become plentiful. The additional dip in price at the end is due to the opening of controlled atmosphere (CA) storage which will usually be of better quality. The starting price for the fruit from CA storage is higher than the RS prices before the drop. The differential represented, at that time, a premium for the CA fruit that was sufficient to cover the additional cost of CA.

As market conditions have changed, the price patterns through the season have also changed. Prices for the 2000 crop are the extreme case endured by the growers. Prices started out lower than normal because of the knowledge of the large crop. Prices fell as supplies increased. The opening of CA did not generate the boost in price that once greeted the availability of CA fruit. As the season progressed prices continued to decline as shippers tried to get fruit sold and shipped.

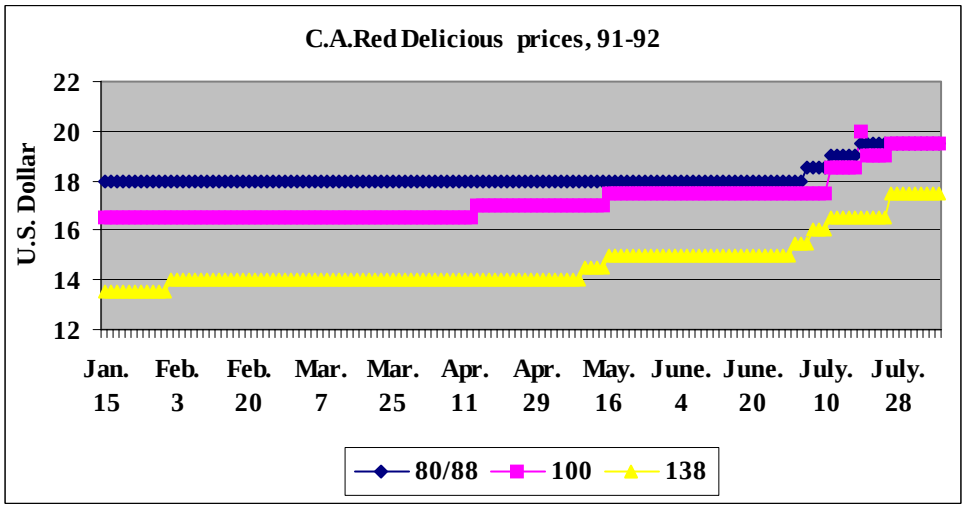
Figure 20: Regular storage Red Delicious prices, 1991-1992.



Source: USDA, AMS, MNS Daily Price Reports.

The other impact of large crops is the narrowing of prices by size. The price spreads seen in Figures 20 and 21 are nonexistent in Figures 22 and 23. The size factor is important. In the past size usually received a premium in the market. As crops have gotten larger those premiums have slipped in amount. However, the grower who has big fruit every year will, on average, receive better returns than growers with smaller fruit. That remains true today. This is particularly important for growers with Gala apples. This variety tends to produce small apples and the market really doesn't want them.

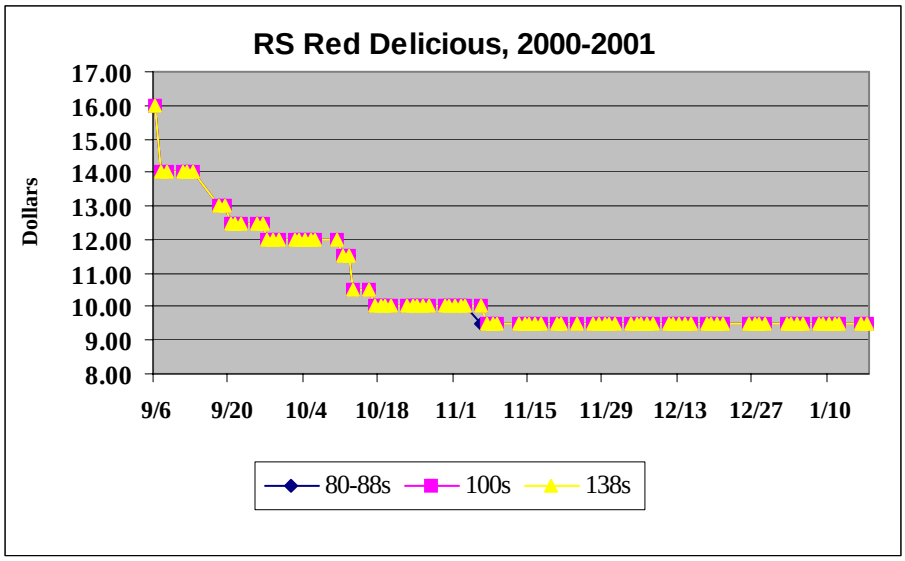
Figure 21: CA Red Delicious prices, 1991-92.



Source: USDA, AMS, MNS Daily Price Reports.

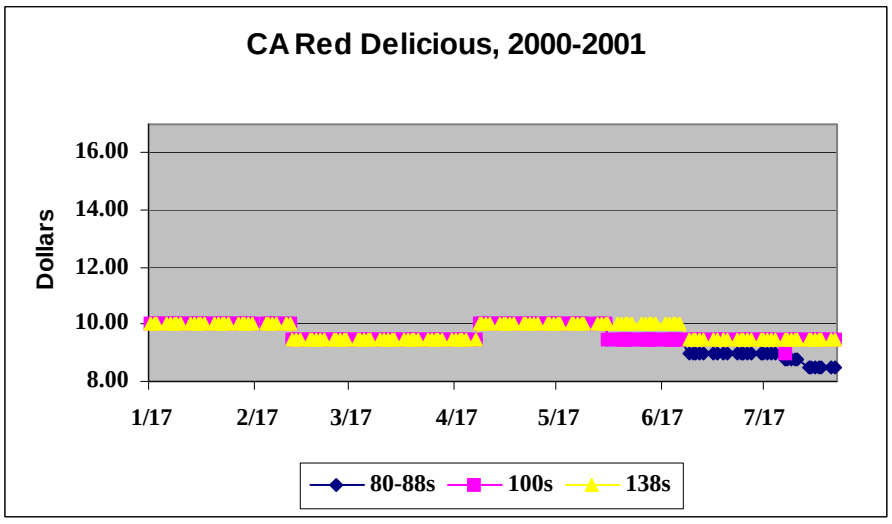
The price patterns through the season are also a measure of the volumes shipped. As harvest begins warehouses begin packing and shipping apples. As the volume harvested increases, the warehouses begin placing fruit in storage as they continue to pack. Shipments increase and reach a peak in December and January. Another peak shipping month is April. From then on, movement slowly tapers until the crop is completely shipped.

Figure 22: Regular storage for Red Delicious, 2000-2001.



Source: Ibid.

Figure 23: CA storage for Red Delicious, 2000-2001.



Source: Ibid.

The advent of CA storage has enabled the industry to move more apples late in the season. When CA storage was first commercialized, about 6% of the crop was shipped during June, July and August. Today the proportion of crop moved during that period is about 19%. That does not count the old crop shipments made in September, October and November. Overlapping shipments (old and new crop) are a recent phenomenon due to really large crops.

Table 8 contains season average price by variety. These averages are reported by the Washington Growers Clearing House. Prices have not been reported for all varieties for all years. In the case of Winesaps, the volume shipped is now so small that the Clearing House does not report the average. Winesaps are an example of a variety that is declining in popularity. It is an old variety that was very popular 100 years ago, but was dethroned by Red Delicious. In the cases of Fuji, Gala, Braeburn and Jonagold, there was insufficient volume reported due to their newness in 1990 (and Jonagold in 1991) to warrant calculating average prices.

As volumes of the new varieties have increased, prices have declined. The least affected by increased volumes have been Gala and Jonagold. Jonagold prices have suffered a relatively limited decline because the increase in volume has been modest. The case of Gala is more interesting. Gala shipments have gone from no shipments in the late 1980's to over 11,000,000 cartons in the 2002-03 market season. Yet, prices have held up reasonably well. Gala apples do have better consumer recognition than the other new varieties because of the efforts of the marketing arm of the New Zealand apple industry which introduced U.S. consumers to the variety. There also appears to have been some cannibalization of Red Delicious by the newer varieties and Gala has probably benefited from this as well.

Fuji prices have benefited from the export market. The early high prices reported in the early 1990's were due to exports to South and Southeast Asia. Those shipments continue to this day and contain some fruit destined for specialty or niche markets that pay very high prices. These markets want bagged fruit and are willing to pay for the brilliant color caused by bagging. Here, "bagged fruit" refers to apples on the tree which are placed in small bags to minimize the amount of sunlight that reaches the fruit (and help protect from disease and insect damage). This retards the development of color. After the bags are removed the fruit develops a red fluorescent color that is considered to be very attractive. These fruit are usually used as gifts in Asian countries and command a very high price which is needed to cover the cost of bagging and removing the bags.

Domestic consumers are still learning about Fuji apples. Recognition of this variety on the East Coast is particularly limited suggesting the possibility of expanded market acceptance.

The Granny Smith variety is a somewhat different case. It has been grown in Washington longer than any of the other new varieties. The late Grady Auvil first planted this variety in the 1970's and slowly built a market for it. Production peaked in the early 1990's and prices dropped below breakeven two years in a row. This led to the removal of some acreage. With the decline in acreage and production prices revived and interest in Granny Smith has increased. In recent years there have been more acres planted to this variety.

Table 8: Average F.O.B. prices by variety.

	REDS	GOLDENS	WINESAPS	ROMES	GRANNY SMITH	GALA	FUJI	BRAEBURN	JONAGOLD	AVERAGE
1990	14.14	14.66	12.65	13.5	13.82					14.13
1991	15.65	16.7	13.9	16.52	18	28.19	40.17	32.23		16.24
1992	12.86	12.83	10.27	11.4	11	29.78	47.02	31.05	20.64	13.41
1993	11.22	16.82	10.06	10.34	12.2	22.51	28.2	18	19.31	12.73
1994	11.78	11.16	10.18	11.02	15.49	23.35	16.63	21.78	19.85	12.94
1995	14.92	15.45	14.25	15.92	18.47	25.29	29.53	21.09	20.5	16.22
1996	12.11	13.19	11.23	14.24	17.3	22.08	19.68	17.26	18.93	13.89
1997	12.34	15.55	13.05	14	15.85	18.37	17.35	16.38	15.72	14.24
1998	9.3	11.14		11.29	15.03	15.79	15	15.5	14.45	11.26
1999	12.04	14.88		13.43	16.47	16.73	18.84	18.39	15.62	14.19
2000	10.08	13.82		11.88	16.03	13.76	12.75	13.67	13.66	11.97
2001	12.46	17.27		13.56	15.69	17.37	17.14	17.75	15.83	14.82
2002	12.34	15.73		15.42	17.37	18.22	20.46	18.76	17.79	15.31

Source: Agricultural Census.

Although popular in fresh form, Granny Smith also has some desirable processing characteristics. These desirable properties usually result in higher prices for Granny Smith in the processing market. There were several years in the early 1990's when the processing price was above the grower breakeven price. A few people planted Granny Smith with this market in mind. However, with the drop in processing prices due to international competition primary marketing focus by growers is back to the fresh market. Because of the experience in the early 1990's the extent of the market for Granny Smith seems smaller than the other varieties, possibly because of its very tart flavor. The recent upswing in plantings may have the capacity to again drive prices below breakeven for the grower.

It is useful to compare the average prices in Table 8 with the breakeven prices reported in the production cost section. Table 9 shows the season average prices from Table 8 for which there is production cost information. The numbers are color coded to indicate which prices are below the cost of production reported by DuBruille. Only Granny Smith prices were above the estimated costs in all of the past 6 years. Gala and Fuji fell below the cost of production in 2000, while Fuji and Goldens were below in 1998. The average Red Delicious price was below in all of the 7 years shown. Since these numbers are all in nominal terms the comparison is not strictly valid, particularly for the early years. That being said, the low returns for Red Delicious in 1996 and 1997 certainly suggest a problem for that variety that began before 1998.

Table 9: Seasonal average F.O.B. prices.*

	Reds	Goldens	Fuji	Gala	Granny Smith
1996	12.11	13.19	19.68	22.08	17.30
1997	12.34	15.55	17.35	18.37	15.85
1998	9.39	11.17	14.99	15.79	15.02
1999	12.04	14.88	18.84	16.73	16.47
2000	10.08	13.82	12.75	13.76	16.03
2001	12.30	17.25	17.11	17.37	15.67
2002	12.34	15.73	20.41	18.22	17.37

** Washington Growers Clearing House.*

ORGANIC PRODUCTION AND MARKETING[22]

What is Organic Farming?

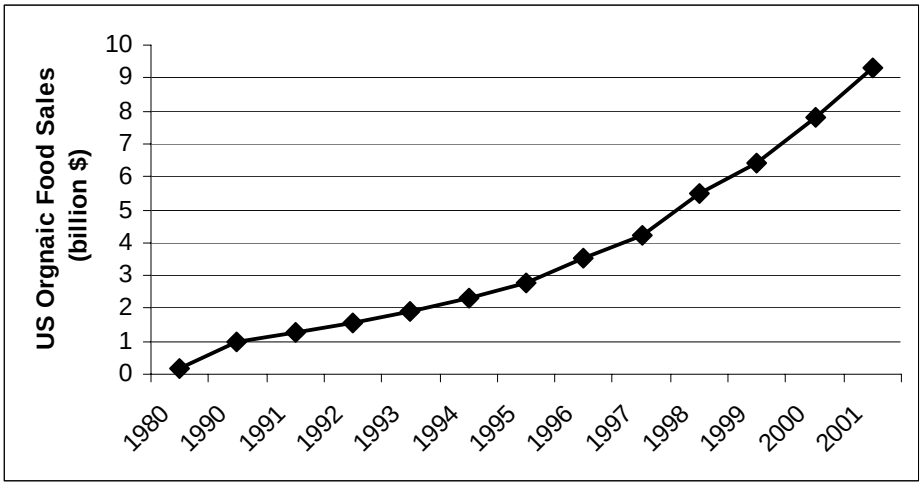
Organic farming is a production system that relies on biological processes and natural products to produce food and fiber and avoids the use of synthetic inputs such as fertilizer and pesticides. The term first came into use during the 1930s and 1940s in Great Britain and the U.S. at a time of serious resource degradation (the Dust Bowl) and the introduction of synthetic agrichemicals. Organic farming began as a philosophic approach

[22] An Organic Overview Prepared for the WAFTA Project by David Granatstein, Washington State University, Center for Sustaining Agriculture and Natural Resources, Wenatchee, WA, December 2002.

to agriculture built around the idea that healthy soils create healthy plants that create healthy animals and people. Since the 1970s, specific legal definitions of organic farming have been developed in the U.S. and other countries to codify the practices of organic farming for the purpose of certification and consumer protection in the marketplace. "Organic" is now a regulated term when applied to food or fiber, based on the federal Organic Food Production Act of 1990. The USDA National Organic Program (NOP) oversees the development and implementation of the national organic standards to which all products labeled organic must comply (as of October 2002).

Organic food sales have grown dramatically over the past decade (Figure 24). During the 1990s and continuing through the present, aggregate sales (retail) have increased between 20-25% per year in every year. The Organic Trade Association tracks these trends and predicts that sales will reach $20 billion per year by 2005. Production of organic foods has obviously increased as well, being pulled by market demand. However, for many crops, production can increase rapidly and potentially overshoot the growing but still small organic market.

Figure 24: Organic food sales at retail in the U.S.



Source: Organic Trade Association.

History of Organic Production in Washington State

During the 1970s, a small number of farmers in Washington State began marketing their products as "organically grown" based on the general guideline of no use of synthetic fertilizers or pesticides and a focus on soil health. As trade expanded, the need for oversight to prevent fraud was recognized. The Washington Tilth Producers group drafted some initial standards and helped lobby the state Legislature for an organic food bill. The Organic Food Products Act was passed in 1985 by the Washington Legislature, authorizing the creation of an organic certification program within the Washington State Department of Agriculture (WSDA). The Organic Food Program (OFP) began certifying farms in 1988 and has expanded dramatically since that time.

The OFP works with producers, processors, handlers, and retailers to ensure the validity of the claim "organically grown." It received accreditation from the USDA NOP in 2002 and now serves as an agent of the federal government in implementing the national organic standards. Program personnel process applications, inspect farms and facilities, collect samples for pesticide residue analysis, and assist with the development of the rules. The Organic Food Program is based in Olympia, WA, and can be reached at (360) 902-1877.

Organic fruit producers have been an important part of the state organic program since its inception. Currently, about 30% of all certified organic acres in the state are in tree fruit (apples, pears, cherries, and other soft fruit), and tree fruit has by far the greatest acreage in transition (Table 10).

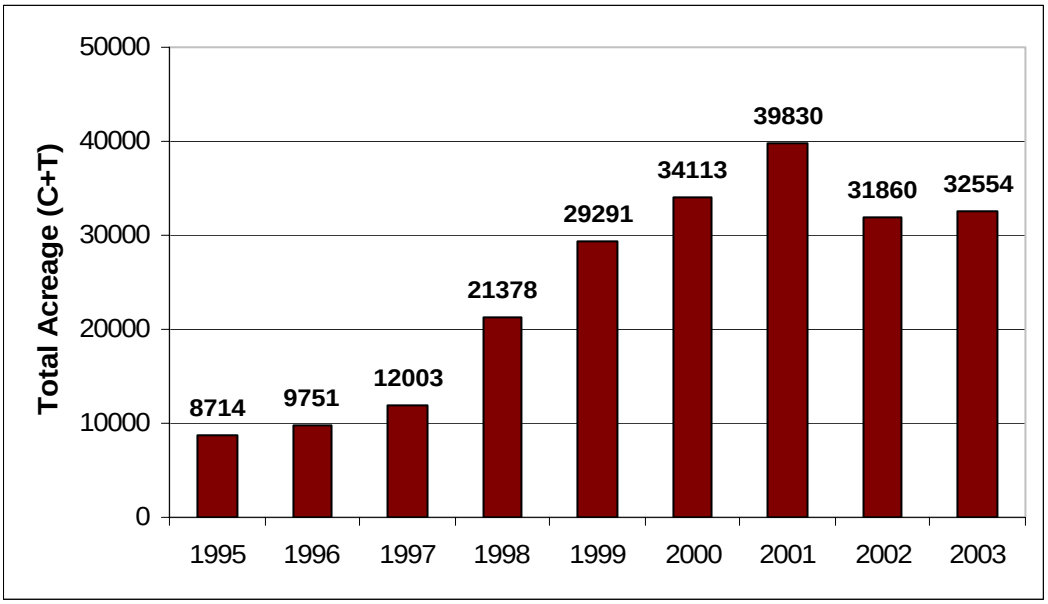
Table 10: Acreages of organic crops in Washington State - 2003.*

	Certified	Transition
Tree Fruit	9354	869
Grapes	1722	282
Berries	350	84
Hay	2833	494
Pasture	781	
Grains	1952	18
Fallow	2278	25
Herbs	883	0
Vegetables	9250	104
Total	30,640	1,914

*Granatstein, D., E. Kirby, and C. Feise. 2004. "Organic Farm Acreage in Washington State – 2003." WSU Center for Sustaining Agriculture and Natural Resources. http://organic.tfrec.wsu.edu/OrganicStats/WAOrganicAcresREV03.pdf.

The rapid growth of organic acreage in the state experienced in 1998 and 1999 may be moderating and come more in line with the continuing growth in demand (Figure 25). There is a required 3-year transition time from the last use of a prohibited material until the first harvest of a certified organic product. Thus, the transition acres registered with the Organic Food Program act as a leading indicator for what acreage might look like in the following two years.

Figure 25: Trends in organic farm acres (certified plus transition) in Washington State.**



* 2002 Change in data source.
**Unpublished data. Source: Washington Dept. of Agriculture Organic Food Program.

Organic Apple Production Trends

Apples represent the largest segment of organic tree fruit production in the state (Table 11). Production occurs in the same areas of central Washington as the rest of the orchard industry. The semi-arid climate of central Washington is amenable to organic apple production due to the low incidence of foliar diseases such as apple scab and relatively few insect pests. Virtually all of the commercial production of organic apples occurs in the semi-arid regions of the western U.S. Washington orchards produce about 35% of the organic apples in the U.S. and about 20% of the organic apples in the world.

Table 11: Acreages of organic tree fruit in Washington State – 2002.*

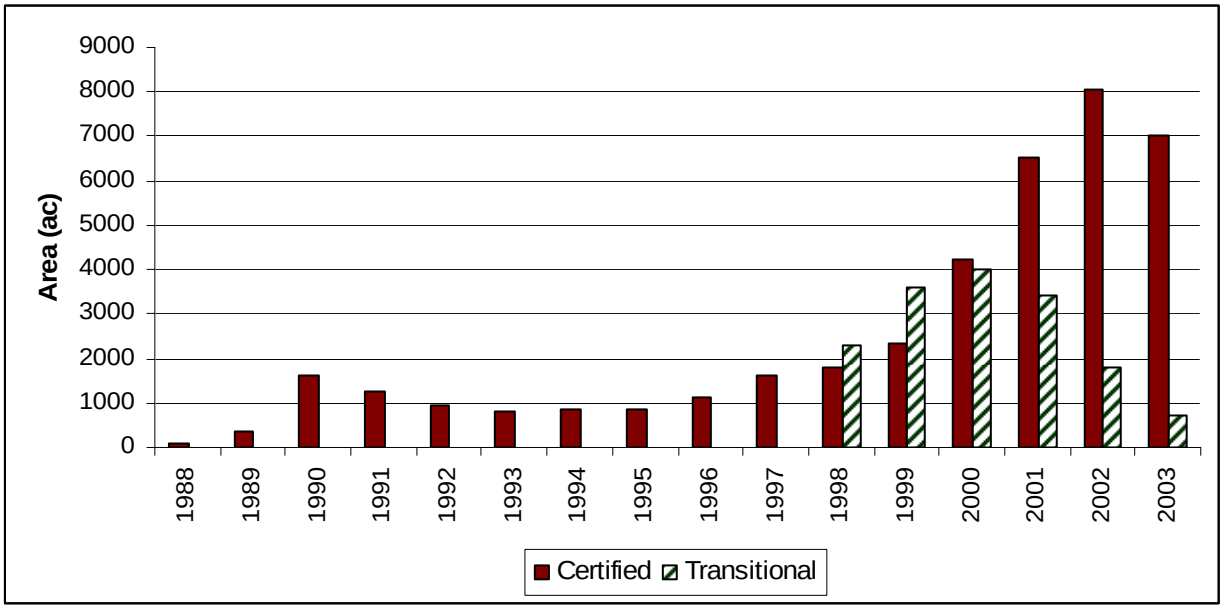
	Certified	Transitional	Total
Apples	7003	719	7722
Pears	1466	80	1546
Cherries	513	58	571
Apricots	78	12	90
Peaches	174	0	174
Nectarines	57	0	57
Plums	63	0	63
Other	1	0	1

**Granatstein, D., E. Kirby, and C. Feise. 2004. "Washington Organic Tree Fruit Acreage Tables – 2003." WSU Center for Sustaining Agriculture and Natural Resources. http://organic.tfrec.wsu.edu/OrganicStats/2003OrganicTreeFruitTables.pdf.*

Production of organic apples increased rapidly in 1989 in response to market losses from the Alar incident (Figure 26). However, many growers were unable to control codling moth, the key apple insect pest, organically or were not willing to expend the extra work to do so under organic management. In the mid-1990s' the advent of pheromone mating disruption for codling moth kindled new interest in organic apple production. In many locations, this organically approved method did successfully control codling moth at a lower cost than previous methods. This technology was largely responsible for the dramatic growth in organic apple production that occurred. Expansion was also due to steadily growing organic markets and to depressed conventional apple prices that motivated orchardists to look at alternatives.

In 2003, certified organic apple acreage made up about 5% of the total apple acreage in Washington State. Information on volume and price is available from the Washington Growers Clearinghouse, but it is not clear what portion of the crop is actually reported. Therefore, estimates of actual production volume are much less certain than acreage, which is reported as part of the certification process. Grower and industry estimates place organic apple production between 2 and 3 million boxes per year. A certain portion of this is marketed as conventional product for a variety of reasons.

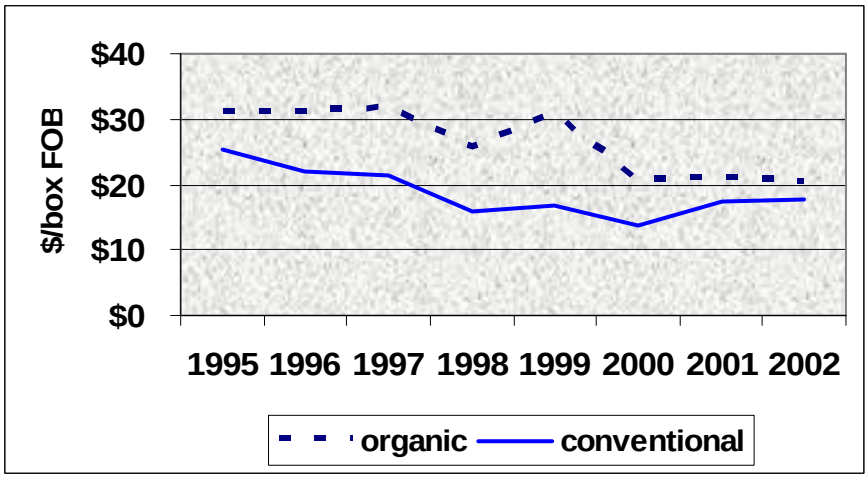
Figure 26: Growth of organic apple acreage in Washington State.**



** 1999 - Alar*
1994 – Mating disruption
*** Updated the original figure from: Granatstein, D. and E. Kirby. 2002. "Current Trends in Organic Tree Fruit Production." CSANR Report No. 4, WSU.* *http://wrganic.tfrec.wsu.edu/OrganicIFP/OrganicFruitProduction/current_trends.pdf.*

Organic apple prices, and their premiums over conventional prices, have declined in the past five years with the increased production (see Granatstein and Kirby, 2002). An example is presented below (Figure 27).

Figure 27: Price trends for organic and conventional Gala apples in Washington State.*



** Updated the original figure from: Granatstein, D. and E. Kirby. 2002. "Current Trends in Organic Tree Fruit Production." CSANR Report No. 4, WSU.* *http://wrganic.tfrec.wsu.edu/OrganicIFP/OrganicFruitProduction/current_trends.pdf.*

Historically, premiums have ranged from 0 to 100% over conventional prices and were variety dependent. Red Delicious variety makes up the largest portion of organic acreage, but newer varieties are expanding. There is evidence that the organic consumer is less likely to favor Red Delicious than the conventional consumer. A produce buyer from Whole Foods Market estimated that Fuji apples outsell Red Delicious by 2:1 in his stores.

As the percent of organic food sales that occurs in mainstream groceries increases (now over 50%), the forces of consolidation and industrialization are occurring in the organic sector just as they have in the conventional sector. Long-time smaller growers and brokers are losing their market connections. Large grower-packers are increasingly involved in organic apple production. Smaller growers are looking for new marketing options to maintain profitability.

ORGANIC APPLE PRODUCTION METHODS

Organic producers cannot use most of the fertilizers and pesticides available to conventional growers. However, an increasing number of production inputs are being developed that are allowed on organic farms and also are attractive to conventional growers. A good example is the product Surround®, a mined kaolin clay product that is sprayed on trees as a particle film to help discourage pests and protect fruit from sunburn. In a recent 3-year study of pest management in pears, Alway (2002) found that an organic insect pest management system controlled pests equal to or better than a conventional or IPM system at lower cost. Thus, the trend towards "softer" pest management in general is leading to a convergence of organic and conventional pest management in Washington apple orchards.

Organic growers do not have a rescue material for codling moth similar to Guthion® (azinphos-methyl) in conventional orchards. Mating disruption is the basis of codling moth management in most orchards in the state. However, it does not perform well at high moth populations. Organic growers attempt to lower populations with the use of summer horticultural oils, *Baccillus thuringiensis* (B.t.)[23], and sanitation. New products such as codling moth granulosis virus and Entrust® (*spinosad*) are providing more tools for a codling moth control program.

In general, organic growers have fewer problems with secondary pests than conventional orchards due to conservation of natural enemies that can provide biological control. Products such as neem, B.t., lime sulfur, oil, and soaps are available. Growers can also use mass release of beneficial insects, but efficacy is unpredictable. Research is expanding on ways to augment biological control through habitat manipulation.

Disease problems are variety and site specific. Apple scab is generally not a problem. Powdery mildew can be a problem on susceptible varieties in a wet spring, as can fireblight. Sulfur, lime sulfur, soap and oil are the primary mildew controls. Antibiotics and suppressive bacteria may be used to control fireblight.

[23] B.t. is a commonly used biopesticide to control lepidopteran pests (e.g. caterpillars). A toxin produced by the naturally occurring bacterium is the active ingredient that must be ingested to be effective.

Tillage is the most common form of weed control in the tree row as conventional herbicides are not allowed. Growers are also trying thermal methods, such as flaming, and the use of mulches and cover crops. Several natural materials are being tested as potential herbicides (e.g. pine oil, acetic acid) and may become available, but their usefulness is not known.

No good controls are available for rodents, and voles (or mice) can become a serious pest.

A typical organic pest management program might look like the following:

- Dormant: horticultural oil, lime sulfur
- Delayed dormant: lime sulfur, horticultural oil , B.t. for leafroller
- Pre-pink: Mating disruption dispensers for codling moth, sulfur, M-pede® for aphid or grape mealybug, B.t.
- Pink through petal fall: sulfur, neem for mealybug
- After full bloom: sulfur, summer oil for codling moth, neem for white apple leafhopper
- Late spring and summer: summer oil for codling moth, B.t. for leafroller, M-Pede® for aphid, Stylet oil for mites
- Postharvest: copper for anthracnose

Research and development of more organic pest control options will continue to grow with the increased interest in organic farming and the regulatory pressures to move towards more environmentally benign farming methods.

Organic growers have a number of fertilizer sources available, including soil applied amendments and foliar sprays. Many growers use a soil amendment such as compost or manure to add organic matter as well as nutrients. However, organic sources can pose a challenge for timing nutrient release with tree need. Foliar sprays such as fish emulsion help with this problem, and sprays for calcium and micronutrients are also available. Research is on-going into the potential to supply a portion of nitrogen internally from legume cover crops. Boron and zinc are generally deficient and need to be added, and calcium sprays are routinely used to protect fruit quality.

ORGANIC APPLE ECONOMICS

Reports on the relative costs and returns of organic apple production in Washington vary with the farm and individual. Growers commonly state that organic production costs about 20% more than conventional production. Some growers feel that this cost difference decreases with time as growers improve their management and the biological transition to organic is completed. There is no clear trend to suggest that organic apple

orchards yield less or lower quality fruit. Yields and packouts appear to be in the same range as conventional orchards based on grower reports. However, organic orchards can be more prone to biennial bearing due to fewer options on fruit thinning and the difficulty in closely managing nitrogen. A biennial bearing orchard will reduce farm profitability.

A long-term study of conventional versus integrated versus organic apple production in the Yakima Valley provides the most comparable results (Glover et al., 2002; Reganold et al., 2001). Fruit tree growth and yield were not significantly different over the first six years of the study. The authors estimated that a 12-14% price premium was required to match the breakeven price with conventional. Fruit thinning, weed control, and fertilization are the areas of greatest cost increase for organic apple production. New techniques are being developed for allowable chemical thinning in organic orchards. This will represent a major cost savings. Potential cost savings for weed control and fertilization are fewer and smaller.

With the downward trend in all apple prices, including organic, it becomes critical to look at breakeven cost of production in addition to the price premium. Since the premium is the difference between organic and conventional prices, a bigger premium is needed to achieve breakeven when conventional prices are low due to a large crop. When conventional prices are below the cost of production, as they have been, an organic premium of 12 -14% may not be enough to breakeven. And the recent price decline points out clearly that organic apple prices do respond to changes in supply as well as demand.

FUTURE OUTLOOK

The future outlook for organic apples in Washington State is positive. The state is one of the premiere growing regions for organic apples and has the infrastructure to consistently deliver high quality product to market. Foreign competition is a concern. Already New Zealand Gala organic apples have competed for market share with Washington organic Galas. The status of organic apple production in China, the biggest competitive worry, is unknown. However, the organic food market will continue to grow. It represents about 2-3% of food sales, yet the core organic consumer represents about 7% of the population (Hartman, 1996). A recent report by The Packer suggested that apples are the number one produce choice of organic consumers.

International trends in organic certification will likely influence producers here. European programs are actively working on the incorporation of labor standards into organic production. Other ecolabel programs are emerging that deal with additional issues, such as energy and biodiversity, which are not covered under the NOP. However, given the lengthy battle to get the national organic standards approved, it is unlikely that the USDA will open the door to a discussion of possible labor standards any time soon. Their biggest challenge will be to clarify many of the gray areas of the standards and work on international harmonization so that organic fruit produced in Washington State does not run into barriers when being exported. This has been a concern for fruit sold to the United Kingdom.

FURTHER READING

A number of reports are available at
http://organic.tfrec.wsu.edu/OrganicIFP/Home/Index.html
These reports expand on the topics presented in this brief description of the organic sector.

GROWER-SHIPPER INTERFACE

While the foregoing information details the industry from several perspectives, it does not really cover the relationship between the grower and the shipper. Each year the grower signs a contract with a particular warehouse that stipulates that the grower will deliver his/her fruit to the warehouse. In years past the grower typically delivered all of the fruit to a single warehouse. Today, that is not necessarily the case. Some growers will split his fruit among warehouses according to the warehouse's marketing success with specific varieties. Others will deliver the same variety to more than one warehouse as a way to monitor each warehouse's ability to pack and market the fruit. A larger grower is more likely to do this.

Most growers will contract with the same warehouse year after year, but there is some number of growers that change warehouses every year. Within the industry this "floating" tonnage is thought to be about 10%.

In return, the warehouse commits, in the contract, to handle and sell the grower's fruit in the most efficient manner possible. No mention, let alone guarantee, is made of the actual price to be paid the grower. It should be noted that the grower retains ownership of the fruit until such time as it is accepted by the final buyer (wholesaler, retailer or food service purveyor). Warehouses will occasionally buy fruit from growers, but it is not a common practice.

The decision to remain with a warehouse is, in fact, a two-way street. Not only are there growers who become sufficiently displeased with returns and/or service of a particular warehouse to change, but warehouses will also become unhappy with growers and refuse to handle fruit from those growers in the future. Grower dissatisfaction usually revolves around the returns (either prices or charges) or issues about fruit handling. Warehouses do, sometimes, lose track of fruit to the detriment of the grower. Only the diligent grower who totals up bins delivered will find any such errors. Errors found by the warehouse in the accounting of the fruit delivered may or may not always be reported to the grower.

Warehouse dissatisfaction usually involves fruit quality. Growers unwilling to harvest according to warehouse instructions are sometimes sufficient cause for the warehouse to sever relations. The issue of harvest timing is significant. Having an adequate volume available at the start of harvest is important to warehouses with close or contractual relations with buyers. Keeping enough fruit in the system to avoid stock-outs is critical.

Harvest timing is also important to the sales strategy of the warehouse. The warehouse wants an adequate volume of fruit in each type of storage to ensure that sales

will be evenly allocated across the entire marketing season. Hence, there is a need for some fruit to be harvested earlier for placement in C.A. storage to accommodate late season (June, July and August) sales.

Private warehouses have more latitude in dealing with growers who do not cooperate with warehouses regarding either production practices or harvest. Since the contracts are only one year in length, the relationship is easily terminated. Cooperatives, on the other hand, are constrained by the fact that the growers are owners of the firm and termination of a relationship is more difficult.

From a grower's perspective the manner in which returns are calculated is important. Some warehouses keep track of each grower's fruit until it is sold and the grower receives the actual price paid by the buyer less the warehouse and industry charges. This manner of accounting is called "account sales". When the grower is paid on the basis of account sales the critical issue is determining whose fruit to pack at any point in time. In some years the timing of sale can cause a significant variation in grower receipts.

Many warehouses "pool" the receipts from the sale of fruit and pay each grower an average price. In these payment schemes the manner in which the pools are defined is critical. A single "pool" for the entire market season has an inherent bias due to the way prices typically change through the season and the characteristics of the fruit destined to be sold at various times of the year. The pooled prices are calculated by size and grade. The large extra fancy fruit sold late in the marketing season usually receive the highest prices. There are fewer large extra fancy fruit available late in the market season because those fruit have been picked early before they've been able to achieve a larger size. In fact, it really means a smaller proportion of large fruit.

Growers who leave the fruit on the tree longer will have more large extra fancy fruit, but these fruit will not generally store as long. Hence, the late harvested fruit must be sold sooner. These fruit will be sold during the period when prices are low, i.e., during those months when shipments are highest. In the averaging process the low priced fruit benefit from the late season sales and the apples sold late suffer from the prices received for the late harvested fruit. This is the inherent bias that occurs in a single pool system.

Warehouses are aware of the bias and have created other schemes to offset it. Some warehouses have multiple pools. Others will have a single pool, but build incentives into the system to increase the availability of fruit later in the market season.

Actual payments to the growers are conditioned by the accounting system of the warehouse. In the account sales system payments to the grower are supposed to occur within 30 days of the sales of the fruit. In a pooling system, full payment is not rendered until after the pool is closed (all fruit in the pool are sold). So, for example, apples in an early season pool may be completely sold by February or March with the growers getting paid a month later. Fruit out of late season C.A. may not get completely sold until September or October of the following year.

The cash flow for a single apple crop can be stretched over nearly two years with expenses occurring in the first year and receipts in the second. In February 2003, for example, growers started paying wages to people to prune the trees. Other cash outlays occurred through harvest in the fall of 2003. Some payments were made by the

warehouse to the grower in early 2004 for the fruit sold during the fall of 2003. Final payments for the last fruit sold from the 2003 crop were not made until September or October 2004.

Because of the lag associated with the payments for the fruit warehouses will give growers advances on the expected value of the fruit. Those advances will not be 100% of the value, but they will cover most of the value.

The issue of cash flow is important to all growers, but those who must obtain operating loans have additional cash costs to cover when labor costs increase. An increase in wages will increase the size of the operating loan needed which increases the amount of interest the grower must ultimately pay.

Warehouse Reports

Warehouses provide detailed information back to the grower regarding the grade and size of the fruit. Growers usually receive a printout that shows the number of fruit or cartons by grade and by size. The electronic equipment used in many warehouses counts each piece of fruit as it is being graded and sized. Some warehouses also provide information on the factors causing cullage.

The other information given to every grower is the pool closing form (or account sales record). Table 12 is an example of an actual pool closing form from a firm no longer in operation. It shows the number of packs by grade and size. Some warehouses now show the number of fruit rather than the number of cartons. As warehouses adjust to handle different kinds and sizes of cartons, a simple count of cartons becomes meaningless.

This particular record (Table 12) shows two grades. Today, warehouses may have five or six categories, particularly for Red Delicious where the Washington Extra Fancy fruit are segregated into as many as three levels according to the amount of red color on the fruit. In addition to the color differentiation in the WA extra fancy grade, other grades sorted can be Washington Fancy, U.S. Extra Fancy, U.S. Fancy, Fancy Standard, and U.S. No. 1. The Fancy Standard grade is used when fruit supplies are low and some buyers are willing to accept low grade fruit to get a lower price. Copies of the grade standards can be obtained from the Federal-State Inspection Service office in Yakima or Wenatchee.

Fruit size has traditionally been measured in terms of the number of fruit per 42 lb. carton. Hence, a size 72 apple (indicating 72 apples per carton) is bigger than a size 100 apple.

All of the assessed charges are listed in the record along with the warehouse's charges. Industry assessments are collected for the Washington Apple Commission, the Tree Fruit Research Commission and where the costs are shared, for inspection. Members of the Washington Growers Clearing House are also assessed membership fees and those fees are collected by the warehouse.

When the sales receipts are pooled, average prices cannot be calculated until all of the fruit in the pool have been sold. Each grower will receive a pool closing form for each of the pools in which he has fruit.

These pool closing forms are actually a very good source of information regarding the production in the orchard, or block, depending on how the grower manages to organize harvest and track the fruit. Growers can easily tell how close their fruit match the wants of the market by comparing the number of packs to the higher prices. In Table 12 the size distribution is heavy to the smaller sizes, suggesting that both pruning and thinning could be improved. The relatively heavy volume of fancy grade fruit as indicated at the top of the form indicates inadequate pruning. The income lost due to these problems can be determined by shifting the size and/or grade distributions to calculate the change in receipts. Other questions such as the income lost by delivering cull fruit to the warehouse can be answered as well.

The other useful information often provided by the warehouse is the cull analysis form. This form shows the problems that caused the fruit to be placed in the cull bin. Table 13 is an example of a cull analysis sheet. It shows the proportion of culls that were placed in the cull bin by type of cull factor. The right hand column is an extra piece of information that can be calculated from the pool closing form to measure the loss associated with each factor. Most warehouses do not do the economic calculations for the growers.

Table 12: Pool closing form.

	Packout	Production		
% Culls	32.2	32.2	No. of Bins	409
%XF	50.5	34.2		
% Fancy	41.2	27.9	Field Boxes	488
% Fancy Del.	8.3	5.6	(Fancy Del)	
TOTAL		100		

GRADE	SIZE	NUMBER OF PACKS	F.O.B. PRICE $	TOTAL VALUE $
	64/lgr	31.0	$17.94	$556.30
E	72's	73.0	$17.94	$1,309.99
X	80	377.0	$16.70	$6,295.48
T	88	408.0	$16.70	$6,813.15
R	100's	748.1	$15.95	$11,931.48
A	113's	491.0	$10.47	$5,139.77
	125's	391.0	$9.97	$3,898.07
	138's	202.0	$9.97	$2,013.84
	2 1/2	173.0	$9.67	$1,672.98
	2 1/4	64.0	$9.67	$618.91
	TOTALS	**2958.3**		**$40,249.95**

GRADE	SIZE	NUMBER OF PACKS	F.O.B. PRICE	TOTAL VALUE
F	64/lgr	23.0	$14.17	$326.01
A	72's	44.0	$14.17	$623.67
N	80	201.0	$13.67	$2,748.71
C	88	350.0	$12.53	$4,384.54
Y	100's	497.0	$12.53	$6,226.04
	113's	434.0	$12.53	$5,436.82
	125's	430.0	$10.13	$4,356.59
	138's	197.0	$8.48	$1,671.46
	2 1/2	139.0	$7.98	$1,109.98
	2 1/4	97.0	$7.98	$774.59
	TOTALS	**2412.2**		**$27,658.41**
XF + F PACKS		5370.5		
3rd grade total		488	$7.92	$3,867.34
Total all grades		**5858.513**	**$12.25**	**$71,775.70**
	Processor lbs.			0
	Culls lbs.	121231	0.01	$1,212.31
TOTAL GROSS FOR VARIETY				**$72,988.01**

LESS ALL CHARGES				
409 Bins @ $6.30	Fruit Handling			$2,576.70
409 Bins @ $8.40	Pre-sort & Size			$3,435.60
5370.5 BXS LAB & MAT-XF & F			@2.83	$15,198.55
488 BXS LAB & MAT-X			@2.83	$1,381.04
TOTAL CHARGES				**$22,591.89**
409 BINS STORAGE	@$4.20			$1,717.80
5858.5 BXS BROKERAGE			@.16757	$981.71
5858.5 BXS MARKETING			@.30714	$1,799.38
5858.5 BXS ADV. RES. & INSP.			@.14000	$820.19
TOTAL INDUSTRY CHARGES				$3,601.29
TOTAL CHARGES				**$27,910.98**
NET PROCEEDS		**$**	**45,077.03**	

Table 13: Cull analysis sheet.

CULL FACTOR	%	RETURNS REDUCED BY
SCALE	1.4	$2,089.92
SPLITS	0.5	$746.40
WINDFALL	0.1	$149.28
WATERCORE	0.1	$149.28
DROUGHT	4.4	$6,568.31
CUT WORMS	0.1	$149.28
WORMS	0.4	$597.12
STEM PULL	1.4	$2,089.92
DECAY	1	$1,492.80
BIRD PECK	1.4	$2,089.92
HVY RUSSET	6.7	$10,001.74
GROUNDER	0.1	$149.28
STEM PUNC	3.8	$5,672.63
BRUISES	6	$8,956.78
DPA BURN	0.4	$597.12
SMALL	3.1	$4,627.67
LIMB RUB	1.8	$2,687.04
SCAB	2.3	$3,433.43
CUTS	3.1	$4,627.67
BITTERPIT	2	$2,985.59
SUNSCALD	13.8	$20,600.60
NO COLOR	36.8	$54,934.94
SHAPE	8.2	$12,240.94
HAIL	1.1	$1,642.08

THE WAREHOUSE SECTOR

The Packing Process

As apples come into the warehouse they are drenched with cold water to remove the field heat. The drench will usually contain chlorine to disinfect the fruit, bins and debris to minimize the occurrence of disease in storage. A sample of fruit is also usually taken at this time. The sample helps the warehouse evaluate grade, size and firmness of the fruit. Harvested apples are placed in bins by the pickers. These bins contain 850-1000 lbs. of apples. The fruit will remain in these bins in storage until the decision is made to grade and sort the apples at which time the bins are taken from storage to the packing facility.

The fruit are stored according to the firmness. Softer fruit are placed in regular atmosphere storage (just cold) or short term controlled atmosphere (CA) storage (lower level of oxygen and low temperature) with the intention of selling these fruit during the fall or early winter. Firmer fruit are placed in other CA storage rooms for sale later in the market season.

There are two primary types of packing systems, commit to pack and presize. A commit to pack system is really an upgrade of the system that was used before the advent of presizing. In a commit to pack, or conventional, system the fruit are emptied from the bins and the really small apples are removed. The fruit are moved onto the grading table where graders remove the defective fruit. The defects include shape, insect stings and disease. Sunburned apples, for example, will be discarded.

Technologically advanced commit to pack systems will have color sorters that separate the fruit by color and divert each piece of fruit to the appropriate station for packing. Each piece of fruit is also weighed. If the system is large enough there will be packing stations for each grade and size the warehouse has committed to pack. In Red Delicious, for example, there may be as many as 50 categories with 5 grade classifications and 10 different sizes. The reason for the large number of categories for Reds is that the equipment has the ability to identify various amounts of color. Given this ability to sort by color and the volumes of Red Delicious produced each year the industry has been able to differentially price by amount of color. Other varieties are not currently segregated quite as finely, although, as new strains of Gala and Fuji are introduced, we will likely see the same thing happen with those varieties.

In the oldest packing systems, after grading and sizing, the fruit are placed on trays and put into cartons by hand. Newer systems have the capacity to automatically place the apples on trays and then the trays are placed in the cartons. The technology exists to mechanically place the trays into the cartons, but the cost of the equipment has been sufficiently high to keep most warehouses using people to do this. As the minimum wage continues to increase, there is increased pressure to substitute equipment for people.

The cartons are then placed on a conveyor system that passes over a scale to check box weight. The weight of the box is also a factor of grade (as are the weights of the bags). If the box doesn't weigh enough it can be rejected. Hence, warehouses will put slightly more weight in the box to ensure there are no problems. Historically, the industry

added another ½ lb. or so to be safe. With the more accurate equipment in use today, the extra weight needed may not be as much, as the range of size within each size category is more closely managed.

While on the conveyor the cartons are also marked with the grade and size, and, in some cases, a grower code. This is for purposes of food safety. If a problem should arise, the warehouse wants to be able to trace the fruit all the way back to the grower.

The cartons are taken to a palletizing area where they are placed on pallets. Each pallet contains 49 cartons. Each fully loaded pallet is then placed back in storage.

Some fruit such as U.S. fancy size 150's and smaller may also be run over the grading table and the sizer. However, if the warehouse has too many small fruit they may move them completely through the system and then put them back in bins for delivery to the processor.

The system is called commit to pack because the warehouse commits to pack the fruit at the time the bins are initially emptied. This is a serious commitment as a wrong decision (inability to sell) means that the warehouse will have to have each carton emptied into bins for shipment to processing.

Salesmen in these warehouses make their sales based on the inventory of packed fruit. If there is an insufficient volume of fruit in a particular variety with the desired grade and size, the warehouse will either have to forego the sale or find enough fruit from another warehouse to complete the sale. With the establishment of the Washington Apple Growers Marketing Association the problem of lost sales due to insufficient quantity has been reduced as warehouse are less afraid to talk to each other about inventory issues.

In a presize system the process of grading, sizing and packing is separated into two distinct steps. The bins are emptied as described above and run over the grading table and through the color sorter and sizer. The fruit are then reaccumulated in flumes filled with water and placed back in bins. Whereas the inventory management problems of keeping fruit segregated by grade and size in the commit to pack system is based on packed cartons, the inventory system for the presize system is composed of presized fruit in bins. Sales activity in a presize firm is based on presize inventory.

Once a sale has been made, the fruit associated with that sale are brought from storage and packed. Prior to packing in both systems the fruit are washed, dried and, for some varieties, waxed. The process for packing is the same as described in a commit to pack system.

Warehouse Economics

Warehouses have suffered financially right along with growers. Over the years some warehouses have merged with other firms and some have failed. Table 14 shows how warehouse numbers changed during the 17 years from 1985 through 2002. Hidden behind these numbers is the fact that a disproportionate number of cooperatives have disappeared. For example, in 1980, there were at least 11 warehouses between Brewster (Okanogan County) and the Canadian border, six of which were cooperatives. In 2002

there were 5 warehouses remaining, two of which were cooperatives. By mid-2004 one of the cooperatives was in the process of merging with a cooperative in Chelan.

The decline in numbers has been a result of two pressures. First, packing and storage technology has changed significantly over the past 20 years. The advent of presize technology and the introduction of electronic sensing have created a significant cost advantage for those firms willing to make the capital investment and have the volume of fruit needed to use the equipment efficiently.

Table 14: Washington apple warehouses.

	Yakima	Wenatchee	Total
1985	70	84	154
1995	60	39	99
2002	51	31	82

Source: Yakima Valley Growers-Shippers Association and Wenatchee Valley Traffic Association.

The initial advantage associated with the presize system was that the grading and sizing operation was not affected by the rate of packing. In fact, as the presize system was installed by more and more warehouses, they soon learned that the initial rated capacity of the system was understated. Those warehouses were soon looking for more fruit to store and pack.

Further, these systems were often installed with the idea of adding new technologies as they became available. The color sorter was the first to be introduced. Then came electronic weight sizing. By 2004 warehouses were adding equipment that measures soluble solids of each individual fruit. This latest technology measures the sweetness of the fruit. This technology has been in use in Japan for at least ten years, but could not, until recently, operate at speeds consistent with the flow of fruit in Washington warehouses. Other labor saving technology is used in Japan, but, again, does not have the capacity to operate at speeds suitable for Washington.

The other new technology used by some firms was nondestructive pressure testing. Certain levels of firmness are required by the grade standards. Until the introduction in 2003 of nondestructive testing, samples of fruit were measured for firmness using destructive tests. Now, rather than relying on samples, each piece of fruit can be measured for firmness.

Over the years the knowledge gained in operating presize systems has been applied to commit to pack lines so that the packing operation is less constraining. In fact, the commit to pack lines used today are preferred for some varieties of apples because they tend to cause fewer bruises.

Another factor causing reduced numbers of warehouses was the economic environment over the past 5 years. The FOB prices made it difficult for warehouses to increase charges to cover rising costs. Those warehouses with orchards suffered a

double hit, especially if they were growing many Red Delicious apples. At the same time it should be noted that some warehouses with orchards have been able to remain in business, so orchard ownership has not been a sufficient reason for failure.

With the decline in warehouse numbers there has been a commensurate growth in the average size of operation. However, it appears that only some of the warehouses have expanded rapidly. Figure 28 shows how the largest warehouses grew during the 1990's. That trend continues. Both mergers and closures in the intervening years means that the remaining warehouses are handling more fruit. The top five may now have 30% or more of the volume.

Figure 28: Washington warehouse shares.

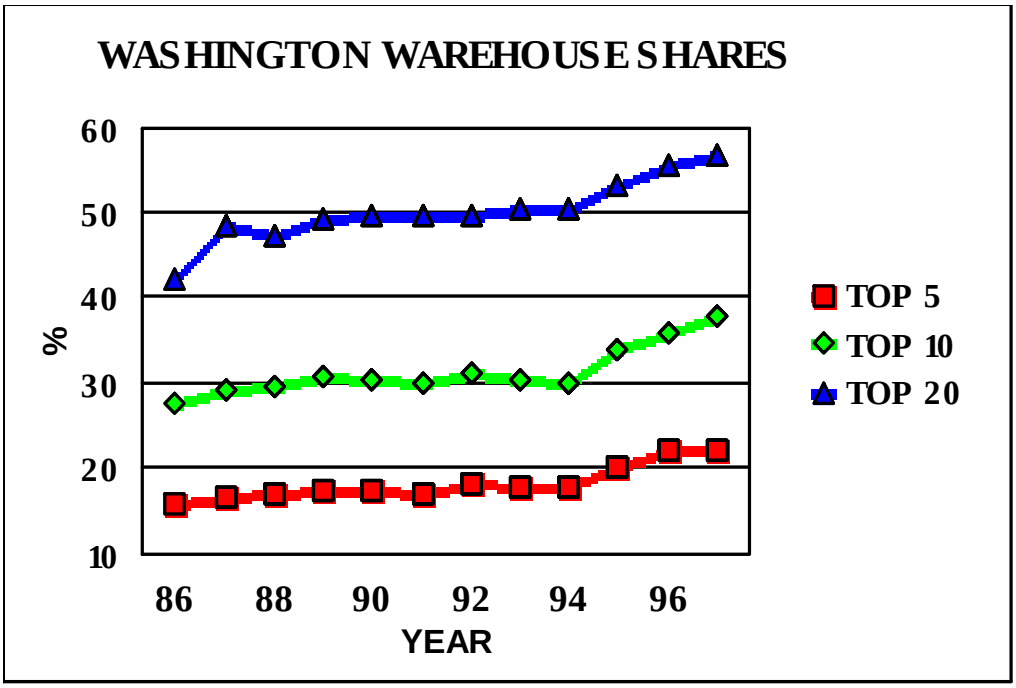
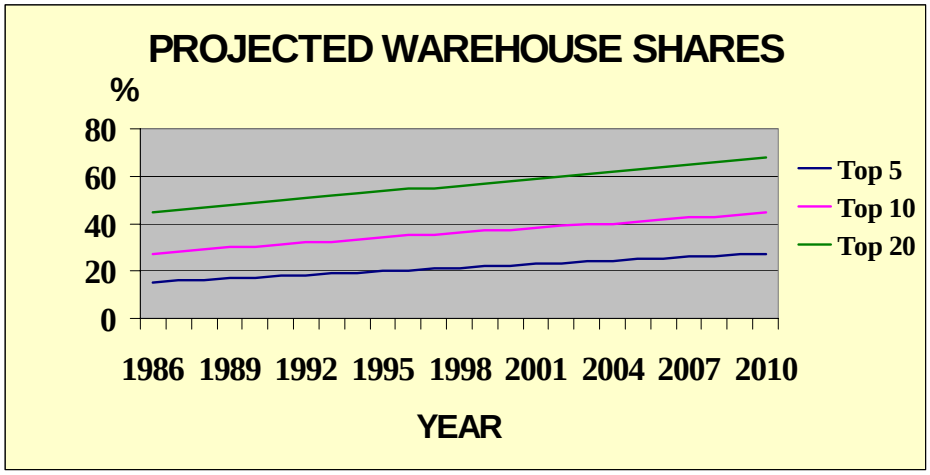


Figure 29 is a simple extrapolation of the data in Figure 28. More recent data are not available to check the accuracy. However, it is likely that it seriously understates the growth in the volumes handled by the largest firms.

Historically, warehouses did not consistently operate more than one shift per day. During harvest and into the holiday season some warehouses would operate two shifts to ensure adequate supplies of packed fruit were available during the peak sales period. In recent years more houses are operating two shifts and it is likely that we will see houses operating 3 shifts on a regular basis in the not too distant future. As warehouses install labor saving technologies, their ability to staff multiple shifts increases. They also suffer less reduction in production per shift, a common problem when going from day to swing or night shifts.

Figure 29: Projected warehouse shares.

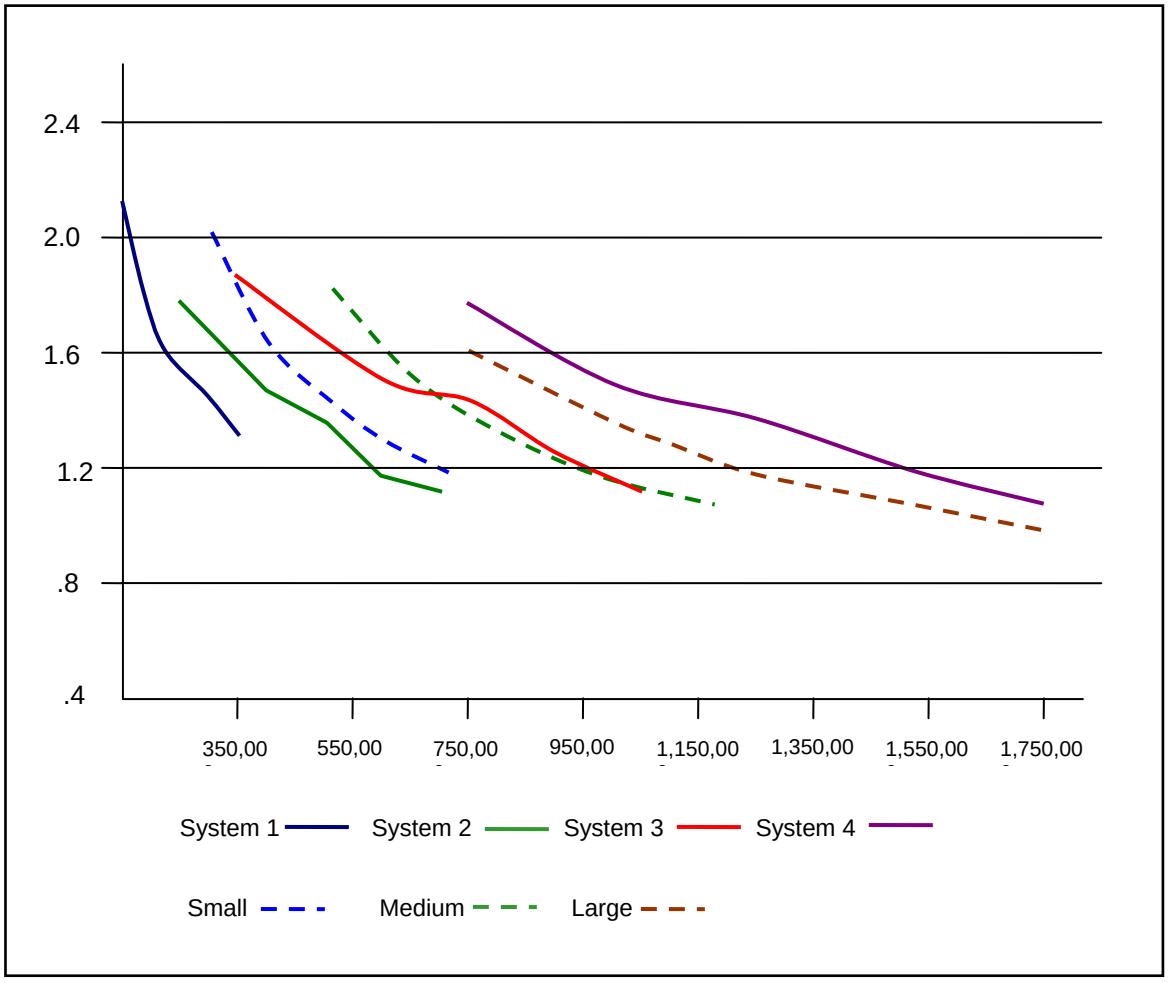


In the warehouse, until recently, the focus has been on reducing costs per shift or increasing production per shift. One can find, for example, different philosophies with respect to the number of people involved in grading and their locations. These philosophies result in packs of different quality and FOB price. This does not mean that one is wrong and one is right, but that they are different and target different segments of the market. However, bigger gains will likely result from running the extra shifts each day, but this also suggests some excess capacity in the industry.

Current cost information on packing is virtually nonexistent in the public domain. None of the warehouses are public corporations and are exceedingly reluctant to share cost information. Old data from a research project on packing systems is useful in showing the economics of packing with newer technologies.[24] Figure 30 shows the impact of size and technology on costs. The annual volumes handled are represented by the horizontal axis and the cost per carton is on the vertical axis. Two different systems are portrayed. The conventional system is much the same as commit to pack. These costs are about 20 years old and do not include packing materials, office expense or storage. The most efficient system is the large presize system. In real life some of the warehouses have been able to continue using old packing equipment that has been completely depreciated. As a result it is possible that a small warehouse can have very competitive costs. Figure 30 is based on new equipment costs.

[24] Schotzko, R.T. Apple Packing Systems: Comparison of Selected Costs between Conventional and Presize Systems. EB 0935, Cooperative Extension, Washington State University, August 1981.

Figure 30: Estimated packing cost relationships. System: conventional versus presize (small, medium and large).



Obviously, over time the advantage goes to the larger operation and this is exactly what has been happening in the industry. Mergers, acquisitions and closures have provided the opportunity for some firms to garner more fruit to take advantage of the larger systems.

The warehouse industry has only recently begun to realize that building large expensive plants that are operated only one shift per day is not very efficient. Using updated costs for the original warehouse study a mock model of a complete warehouse was built.[25] This model can be used to show the effects of operating more than one shift per day. A doubling of the volume handled by the warehouse improved packing costs about 12%. Another 50% increase in volume dropped per pack costs another 5%. In effect, running 3 shifts per day reduced packing costs per carton by 15 – 20%. There is nothing in the orchard that can be done to achieve any similar reduction in costs. Today, more warehouses are operating more than one shift.

[25] O'Rourke, A.D. and R.T. Schotzko. "Economic Feasibility of a Fruit Packing and Storage Facility in Port of Pasco North District, Basin City." Sponsored by the Port of Pasco, Pasco, WA, 1985.

The one constraint using current technology is the number of people needed to operate these systems. Finding enough people in the smaller communities is very difficult. Hence, the industry is slowly consolidating in and around the cities of Yakima and Wenatchee.

Are warehouses profitable? On the surface, one would think that to be the case. Given that warehouses handle all of the money from the sale of fruit and deduct packing charges before remitting the remainder to the grower. However, because of the excess capacity in the packing sector, the larger warehouses are constantly looking for more fruit to handle. One of the things growers check is the warehouse cost and this forces the packers to keep costs as low as possible.

The other thing that comes into play is the fact that many of the large operations also own orchards, large orchards. Some of these orchards were heavy to Red Delicious. The extremely low prices for the 1998 and 2000 crops placed severe financial pressures on the warehouses owning these orchards. Not only were they losing money on the crops, they were also faced with large principal payments to their lenders. Not all warehouses have been able to overcome the financial difficulties caused by the 1998 and 2000 crops.

Packing charge information can be obtained from the Washington State Department of Agriculture. Every private warehouse is required to provide to the Division of Livestock their expected charges for the upcoming packing season. These charges are to be reported 6 months before the crop is harvested. Cooperatives do not have to make this report. Personal experience with these reports suggests that the warehouses will tend to inflate the expected charges to ensure that they do not under-report actual charges when they are finally set for the season.

While the industry continues to look for ways to be more efficient and reduce costs, there are new pressures being placed on the industry by retailers. Packaging has become a very important issue. Retailers are asking for (demanding may be a better descriptor) different sizes and shapes. Historically, the industry packed fruit in the 42 lb carton and in 36 lb cartons that contained 12 3 lb bags. Then came other sized bags. After the very large 1987 crop, which induced the industry to increase efforts on the export market, the heavy pack carton became more important. A heavy pack carton contains several more pieces of fruit than the traditional 42 lb carton. For traypack cartons (once the dominant pack) each apple size has its own paper tray into which the apples are placed. When a carton is heavy-packed it contains trays for one fruit size, but filled with apples of the next larger size. For example, heavy-packed 100's would have 113 apples of size 100 (113 is the next size). This change was done to accommodate foreign buyers who retailed the fruit on a piece basis, but paid import duties on a per carton basis. The heavy pack carton reduced the tariff per apple.

Today, the old standard carton is still used and the heavy-pack, but fruit are also packed in Euro cartons, half cartons, reusable plastic containers and in 3, 5, 6, 8 and 10 lb bags, not to mention vexar wraps and triwall bins. Developing the flexibility to pack in these various containers means additional capital investment by the warehouses which, of course, adds to the packing cost. These alternative carton types are demanded by retailers. In some cases the reasoning is reduced labor costs at retail and sometimes to reduce waste management.

The packing charges used by the Washington Growers Clearing House are the best estimates available to the grower community. The estimates for the 2001 crop are as follows: Red Delicious and Granny Smith, $7.20; Fuji, Jonagold, Cameo, Braeburn, and Pink Lady, $7.40; Golden Delicious, Gala, and Rome, $7.50.[26]

Actual grower charges are a function of the volume of fruit, the amount of cullage and the type of storage into which the apples are placed. A common practice among warehouses is to assess an in-charge per bin. This charge can be $50 or more. Then, there is a charge for packing which may just be materials, but usually also includes labor. The regular storage cost is usually included in the in-charge. The cost of CA storage is additional.

Since cull prices have been below the in-charge some growers have begun doing some field sorting to minimize the number of culls delivered to the warehouse. While this increases costs in the orchard, it can reduce warehouse charges by more than the cost increase in the orchard. A grower who has 19 packed cartons per bin pays less in charge per pack than a grower with 17 cartons per bin.

Sales

Like orchards and warehouses, some consolidation has been occurring in sales agencies as well. Each of the large warehouses has its own sales office. But that office may sell fruit from other warehouses as well. This is advantageous for both parties (warehouses). The cost of handling and packing small volumes of fruit increase warehousing costs for the large operators. This is due to the break in product flow that is needed to keep grower lots of fruit separated. The lost time over the course of the season becomes very expensive for the large operator. Large warehouses prefer to have 200 or 300 bin runs rather than 25 or 30 bin runs as 2-3 minutes of production time can be lost between each lot of fruit.

Small warehouses using older technologies pack these small lots of fruit at a reasonable cost (more emphasis on labor) and the larger firms would rather have the small firms take the low volume varieties. The sales office can fill the orders for the large retailers with the main varieties and take fruit from the small warehouse to provide the few cartons needed of Pink Lady, Cameo or Braeburn, etc.

This is a market niche that some smaller warehouses have developed and seems to make good economic sense. Even if their packing costs are a bit higher, it doesn't matter as much since the prices for those varieties can often be higher.

The consolidation of sales offices (some are, in fact, sales agencies) has been driven by the consolidation trend at retail. No one warehouse has the capacity to supply all the needs of the largest retailers. For example, 4 different warehouses supply apples to WalMart under contract.

The imbalance between shipper and retailer is quite large. Kroger, for example, has about 10% of the domestic market. Assuming that they take 10% of the domestic shipments, that means that Kroger needs about 6 million cartons per year. There are

[26] Washington Growers Clearing House. "2001 Annual Summary." Wenatchee, WA, nd.

several warehouses that may have the capacity to supply that many cartons. However, the wants of Kroger cannot be met by any one warehouse. That firm will request only a few of the sizes that the warehouse has available. The warehouse will not have enough volume of those sizes and grades to fill 6 million cartons. Hence, Kroger, and the other large retailers, must buy from several warehouses.

One way to reorganize in order to meet the needs of the large retailers is through the sales agencies. These agencies can, and do, contract with a number of warehouses so that the volume the agencies have available is adequate to supply the largest retailers. So, while there has been a decline in the number of warehouses, there's also been a decline in the number of sales operations. The resulting configuration is as implied above. Some large warehouses also sell for smaller warehouses, particularly those who have specialized in the low volume varieties. At the same time some sales agencies have built a large client base (warehouses) to remain viable operations in the face of retail consolidation.

The consolidation among sales operations has actually been quite rapid. By mid-2004, back of the envelope estimates suggest that the top five sales agencies, in terms of volume, may be marketing over half of the apple crop. At this point there is some optimism that the pendulum of market power has begun to swing back toward the sales agency (away from the retailer).

It should also be noted that some retailers have buying offices in central Washington. Others have contract agents in the area. Ahold, Inc. for example, has a buying agent (private firm) in central Washington.

For the past fifty years apple sales, like all other produce have been on the spot market. Informal relationships have developed over time between buyers and sellers, but sales have essentially been one sale at a time. The buyer takes five cars this week and calls back next week or in two weeks and buys another four cars (or whatever). The inherent flaw associated with the spot market is that it is a price and quantity market. Buyers will often call several shippers (or, when supplies are excessive, the shipper will call the buyer) to get price quotes and then use the lowest quote to negotiate a lower price from the preferred shipper. Since the buyer has the advantage of greater knowledge surrounding each of the quotes, the one quote may actually have been for less desirable fruit (but the same grade); it is difficult for the other shippers to argue with the price quote and will often accept the lower price.

In the spot market environment the sales person was the key individual because that person had access to buyers. The relationships that developed between individual sales representatives and the buyers are very important and have much value. Buyers change sources of product as sales people change firms. The buyers tend to follow the sales person because of that personal relationship.

As that market slowly changes to more formal longer term contracts (6 months or more) those relationships become less important. In these contracts attention tends to shift away from price and quantity and to the provision of services. That doesn't mean price is not important, it means that the price now includes not just the value of the fruit, but also the cost of providing some set of services too. Today, those services most likely include vendor managed inventories and just-in-time deliveries. But, in some cases,

category management is included. Some warehouses in the industry are now building upon the program developed by the Washington Apple Commission.

The factors mentioned earlier that are driving change did not include one significant element. There is a new business paradigm that is a key force in the types of changes being instituted by the industry. While the entrance of WalMart into food retailing has been a major force in the adaptation of this new paradigm, that firm is, by no means, the only driving force. Food manufacturers have also been moving in this new direction. Because of the consumer research associated with both old and new products food manufacturers have a much better understanding of the market for their products than do the retailers. Hence, these firms have been developing much more highly coordinated supply chain systems, including more sophisticated promotion programs.

Supply chain management has been the term most commonly used to describe the new paradigm, although some recent literature now refers to demand chain or value chain to explicitly incorporate the final consumer into the system. The concept of supply chain management is to create a supply system that is coordinated from the very beginning with the raw inputs to the final purchase by the ultimate consumer.[27]

Historically, firms have focused on internal efficiencies, trying to maximize profits by being highly efficient in all activities. Inventories were balanced with production of the finished product which was balanced with consumer demand during the year. While this works for individual firms, it does not necessarily follow that the systems within which these firms operate is the most efficient. The idea of supply chain management is to build a production and delivery system that is efficient. From this perspective individual firms may have some inefficiencies that actually benefit the whole system. For example, it may not be efficient for an apple warehouse to carry excess inventory of packed fruit. However, the cost of storage by a retailer in an urban area, say, New York, is substantially higher than in Wenatchee or Yakima. Therefore, it is more efficient for the system to have larger inventories in Washington and have deliveries of apples scheduled to arrive just in time for shipment to the individual stores.

Of course, this type of coordination requires the sharing of information by both the retailer and the shipper. The shipper needs real time sales data in order to plan shipments. The retailer needs to know actual costs of storage so these costs can be incorporated into the price of the fruit.

Ultimately, one can envision a system that includes the plant breeder, the nurseries, growers, warehouses, shippers and retailers, all very highly coordinated with information flows moving from one end of the system to the other, in both directions. The current system is evolving in this direction. The spot market, a phenomenon that started during the Second World War due to price controls, is still dominant, but some large retailers are now contracting for fruit for extended periods of time. Price is part of the contract, but it covers more than just the value of the fruit. The shipper also provides some set of services along with the fruit. Quite often that set includes the monitoring of sales of apples on a daily basis and organizes the packing and delivery of replacement stock. A few firms, as noted above, also offer category management.

[27] Interest in supply chain management has exploded in recent years. A search of the Internet will yield tens of thousands of sites pertaining to this paradigm.

Category management is a much more detailed program where the retailer shares data on the sale of all apples handled by the retailer. The sales data are evaluated in terms of the price and the amount of shelf space allocated to each apple category. Since thousands of retail stores are enrolled in the program, it has been possible to develop best management practices in terms of pricing strategies and shelf space allocation on a regional basis, and in some cases, on a store by store basis. Some retailers have carried this concept to the ultimate by tailoring each individual store to the demographics of that store's customers.

Warehouses have responded to this new philosophy by altering the way they do business. Contracts are negotiated with individual retailers. Sales people are becoming account managers where more time is spent monitoring movement of apples and coordinating stock replenishment. Some sales effort is still necessary due to the fact that the size categories usually preferred by the retailers come from the middle of the size manifest. This leaves the large and the small fruit that must be sold to other retailers.

Tangential to this issue of increased coordination is the impact of PLU (product look-up) codes that each sticker on the apple contains. These PLU codes are used to electronically track the movement of all products through the store. In order to keep the total number of codes from getting too large, codes are applied (in standardized fashion) to groups of sizes. For example, the code for large Red Delicious apples is used for all apples larger than size 100. The rest of the apples in this variety are classified as small. In fact, a search of the internet yielded a list of PLU codes for fruit. The apple categories were classified either as large or small. The result of this classification scheme is an artificial price break between size 88 and size 100. That break can be as much as $4.00 per carton. Historically, the price spread between 100's and 88's has not been more than $2.00 and occurred as a result of limited supplies of the larger fruit. The size distribution of the crop will typically peak on size 100's. The end result is that most of the crop is sold at artificially reduced prices.

It is interesting to note that retailers have developed a preference for the larger fruit as they have learned that a significant number of customers buy by the piece while the retailer is buying by the pound. If larger fruit are on the shelf, the sales volume by weight increases.

As a final comment regarding the trends in business practices, not all retailers are changing philosophies. Some retailers continue to do business in the same way they have been doing it for the past 50 years. Intuitively, this unwillingness to change seems to be a path to failure.

Price Spreads

The USDA gathers and reports a substantial amount of data on prices spreads for food. Historical data can be found at http://www.ers.usda.gov/Briefing/FoodPriceSpreads/bill/, then chose from several links on this page; particularly, see the link to "The Marketing Bill, 1954-2000." A discussion of the components they detail is available at http://www.ers.usda.gov/briefing/foodpricesspreads/bill/, click on link to the components.

While information is available on Red Delicious apples, it is an average for the U.S. In 2000 growers received about 17% of the retail price for Red Delicious and the difference between retail and grower prices was $0.73. That $0.73 covers everything from the farmgate to the consumer.

The USDA data do show how the various cost categories have increased over the years and caused the widening gap between grower and retail prices. Labor costs are a major factor. Between 1970 and 2000 the proportion of the food bill represented by labor costs increased from 43% to 47%. Corporate profits increased from 4.8% to 5.8% of the total bill. Other than a slight increase in the cost of energy (not transportation) the proportional importance of all other expense categories as defined by USDA declined. That includes packaging materials and transportation.

A more instructive approach to describing margins for purposes of this paper can be provided using some retail price data from the Washington Apple Commission and transportation rates as reported by USDA, AMS, Market News Service. These rate reports are published weekly and detail rates for many fruits and vegetables and locations.

Table 15 shows average annual retail prices. These prices were gathered by the WAC field representatives as they visited stores. They include all varieties, grades and sizes. The primary difference among regions is the cost of transportation. Freight rates per truck load into New York are usually in the range of $3,500 to $4,000. Rates to Atlanta often fall in the range of $3,200 to $3,500. Los Angeles rates, on the other hand, are $1,600 to $1,800. A truckload of apples is assumed to contain 1000 cartons.

The average FOB price for fresh Washington apples from the 1999 crop was about $14.00. At $1.19 per lb, the retail value of a carton of apples (ignoring any spoilage of which there is some small amount) is $47.60. (This is the relevant retailer price as most of the 1999 crop was sold in 2000.) From that is deducted the $4.00 transportation charge ($4,000 divided by 1000 cartons). Then, deducting the FOB price of $14.00 yields $29.60, which is the amount remaining with the retailer to cover all expenses associated with selling those fruit.

Grower returns represent about 14% of the retail value if it is assumed that the packing charge is $7.40. This is quite different from the USDA estimate for Red Delicious. However, this 14% is based on all apples and the prices charged for other varieties are often higher than Red Delicious prices which suggests a wide disparity in numbers.

Table 15: Regional retail apple prices.

	Retail apple prices				
	Midwest	N.E.	S.E.	S.W.	WEST
1990	0.62	0.7	0.62	0.6	0.59
1991	0.93	1.09	0.99	0.92	0.92
1992	0.87	1	0.9	0.82	0.83
1993	0.9	1.05	0.92	0.83	0.86
1994	0.9	1.03	0.92	0.8	0.85
1995	1.05	1.23	1.07	0.96	1.04
1996	0.99	1.12	0.98	0.94	0.98
1997	1.03	1.15	1.04	1.02	1.02
1998	0.97	1.1	1.01	0.94	0.9
1999	1.06	1.13	1.09	1.03	1
2000	1.1	1.19	1.15	1.12	1.13

Source: Washington Apple Commission unpublished reports.

A related issue is the belief within the industry that retail prices are no longer connected to FOB prices. Recent work done on behalf of WAC indicates that retailers do adjust prices as changes occur at FOB. However, the adjustments are not spontaneous nor are they symmetric. Falling FOB prices do result in lower retail prices, but the retailer does not pass 100% of the price decline on to the consumer. Part of the price decline is kept by the retailer. On the other hand, when FOB prices increase, all, or nearly all, of the increase is passed onto the consumer.[28]

Although not directly related to price spreads, a few words regarding the demand for apples seems warranted. Economic studies over the years have generally yielded elasticity estimates below one. This means that as crop size increases the total value of the crop declines. The recent study done on behalf of WAC yielded results that continue to indicate the demand is inelastic (less than one). It is important to also recognize that the converse is true, i.e. when price increases in response to a decline in quantity (supply), the total value of what is sold increases. These are mathematical truisms that can actually be observed in the movement of crop value from year to year, as reported by the National Agricultural Statistics Service.

[28] Van Voorthuizen, Hildagard. "An Economic Evaluation of the Washington Apple Industry's Advertising and Promotion Programs." Unpublished Ph.D. Dissertation. Department of Agricultural Economics, Washington State University, August 2001.

APPENDIX I

Table 16: Per Capita use adjusted for imports and exports, fresh-weight equivalent.

Crop Year	Fresh	Canned	Juice	Frozen	Dried	Other	Total
1980	19.2	5.27	13.01	0.73	0.82	0.72	39.75
1981	16.85	4.35	11.52	0.75	0.82	0.38	34.67
1982	17.54	5.37	14.58	0.82	0.85	0.5	39.66
1983	18.27	5.13	15.83	0.72	1.21	0.41	41.57
1984	18.35	5.01	18.4	0.83	1.26	0.43	44.28
1985	17.26	5.26	18.42	0.81	1.15	0.31	43.21
1986	17.84	4.91	18.18	1.06	0.83	0.38	43.2
1987	20.83	5.38	19.44	1.02	1.21	0.3	48.18
1988	19.84	5.71	19.15	1.08	1.21	0.27	47.26
1989	21.22	5.34	17.35	1.29	1.11	0.23	46.54
1990	19.58	5.5	20.68	1.21	0.76	0.29	48.02
1991	18.11	5.15	18.13	1.12	0.79	0.39	43.69
1992	19.14	5.8	18.73	0.95	1.2	0.6	46.42
1993	19	5.12	21.33	1.08	1.45	0.32	48.3
1994	19.36	5.34	21.28	1.15	1.53	0.5	49.16
1995	18.69	4.89	18.89	1.14	1.21	0.29	45.11
1996	18.67	4.91	20.33	0.99	1.24	0.23	46.37
1997	18.09	5.6	18.47	1.27	0.95	0.66	45.04
1998	18.98	4.37	21.52	0.96	1.18	0.34	47.35
1999	18.51	4.84	21.38	0.97	0.99	0.45	47.14
2000	17.4	4.36	21.63	0.68	0.77	0.35	45.19
2001	15.81	4.73	21.08	0.91	0.9	0.28	43.71
2002	16.0	3.9	21.6	0.6	0.9	0.2	43.1

Source: http://usda.mannlib.cornell.edu/data-sets/specialty/.

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