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Reviewing Potential Local Fruit Markets: A Utah Case Study

Taunya Ernst[1], Sean D. Rowley[1], Brent L. Black[2], and Teryl R. Roper[3]

Abstract

The demand for locally grown produce has increased significantly in recent years as the local food movement has gained national popularity. The question that arises is whether growers can supply sufficient quantities of produce to support local demand. Data for population, fruit production and fruit consumption were reviewed to determine the potential size of the local market in Utah, and determine whether growers can meet the demand for local product. Trends indicate that both the Utah population and the estimated total fruit consumption have increased, while statewide fruit production has declined, shifting Utah from a net exporter of fresh fruit to a net importer. Since suitable orchard land in Utah is becoming more limited, increasing fruit supply to the local market could best be accomplished by increasing yields on existing orchard acreage.

On average, produce grown within the United States travels between 1640 and 3220 kilometers from farm to supermarket (11). For produce imported from other countries, this distance increases significantly. Produce travel distance, or "food miles," has become a concern for a growing number of people who refer to themselves as locavores. This term was first used in 2005 by four California women, and is defined as a person who purchases and eats only locally grown produce (2).

The distance produce can travel and still be considered local varies. Often, local produce is defined as anything grown within 100 miles (161 km) of its market (2), or produce that is picked, packed, shipped and sold within 24 hours (1). For simplicity, local can also be defined as anything grown within the state in which it is sold (2). Farmers' markets and food co-operatives are both methods for facilitating sales of locally grown produce. In recent years, consumer attendance at farmers' markets and local food co-operatives has increased (6). A survey by the United States Department of Agriculture found that sales at farmers markets in the USA have increased from $888 million in 2000 to $1 billion in 2005 (1).

Shorter shipping distances are attractive to consumers interested in reducing their carbon footprint. A carbon footprint is an estimate of how much carbon (or greenhouse gas) a person produces in doing everyday tasks (11), and is one measure of the impact of activities on the environment (5). Another major reason for buying local fruits and vegetables is to help support the local economy (6).

While the locavore and "100-mile diet" concepts work well in California where there is a concentration of horticultural production and a relatively long growing season, other states within the USA may not have sufficient production to meet local needs. In Utah, agricultural land is very limited, with only 2.6% of the total land area in irrigated agriculture (4). Much of Utah's irrigated land is not suitable for fruit production because of unfavorable climate, insufficient water quantity or quality, or soils that are highly alkaline or saline (3). Utah orchards produce a variety of fruits including peaches, apples, and sweet and tart cherries.

As the popularity of the local-food movement increases, questions arise as to the ability of individual states to generate sufficient produce for local demands. The purpose of this study was to review data on population growth, fruit consumption and fruit production to determine the extent to which Utah's fruit industry can meet increasing demands for local product.

[1] Graduate Students, [2] Associate Professor and corresponding author, and [3] Professor.
Department of Plants, Soils and Climate, Utah State University, 4820 Old Main Hill, Logan, UT 84322-4820

Materials and Methods

State population and future population estimates were obtained from the U.S. Census Bureau (8). Fruit acreage estimates and statewide annual production from 1989 to 2009 were obtained from the Utah Agriculture Statistics Service and Utah Department of Agriculture and Food Annual Reports (7). Prior to 1989, acreage and production data were obtained from quinquennial Census of Agriculture reports (9). Per capita fruit consumption was obtained from United States Department of Agriculture - Economic Research Service reports (10), based on nationwide food disappearance estimates. Regression analysis was carried out using the curve-fitting feature of SigmaPlot (version X, Systat Software, Inc., San Jose, California, USA).

Results and Discussion

Population

Historically, the largest fruit producing area in Utah was along the Wasatch Front, encompassing Box Elder County on the north, Weber, Davis and Salt Lake counties, and extending through Utah County on the south. Other parts of Utah with commercial orchards included areas along the Colorado River in Grand County, and the Virgin River basin in Washington County. By the early 1970s, much of the suitable orchard ground in Weber, Davis and Salt Lake counties had become urbanized, and most fruit produced in Utah was from Utah County, with Box Elder County being the second largest production region (12).

Utah's population has steadily increased, with the last decade experiencing an annual growth rate of ≈2.48%, making Utah the fastest growing state in the USA. Predictions are that the state population will reach 3.08 million by 2020 (Table 1). In 2008 Utah County was the second fastest growing county in the state, and the 35th fastest growing county in the nation (8). The city of St. George in Washington County was ranked as the fastest growing metropolitan area in the USA as this area became a popular retirement community. Nearly all fruit production in Grand County also disappeared as this area became a popular vacation spot (centered around Moab).

Per capita Consumption

For the purposes of this review, it is assumed that Utah per capita consumption mirrors national trends. Regression analysis indicates that per capita consumption for apple showed a significant quadratic trend, where peak consumption occurred in 1989, with consumption decreasing in recent years by ≈3.5% annually (Table 2). Per capita peach consumption also showed a significant quadratic relationship in time, with peak consumption in 1990, and a rate of decrease of ≈3.6% annually since 2005. However, cherry consumption has increased ≈6.3% annually in recent years (Table 2).

Production area

Total Utah orchard land in apples, peaches, sweet and tart cherries increased from 3058 ha in 1969 to a maximum of 5694 ha in 1987. From 1987 to 2007 total fruit production area decreased by more than 50% to 2531 ha, the smallest area in 40 years (Figure 1).

The amount of land dedicated to apple production in the state increased from 1117 ha in 1969 to a peak of 2089 ha in 1987. From 1987 to 1989 apple production area dropped 28% to 1498 ha. After this sharp decline, production area has steadily declined to 567 ha in 2009. The decline in apple production area is likely due to a combination of factors,

Table 1. Utah population and projected population. Data are from the United States Census Bureau.

Year	1960	1970	1980	1990	2000	2010	2020
Population (thousands)	891	1059	1461	1723	2244	2672	3084

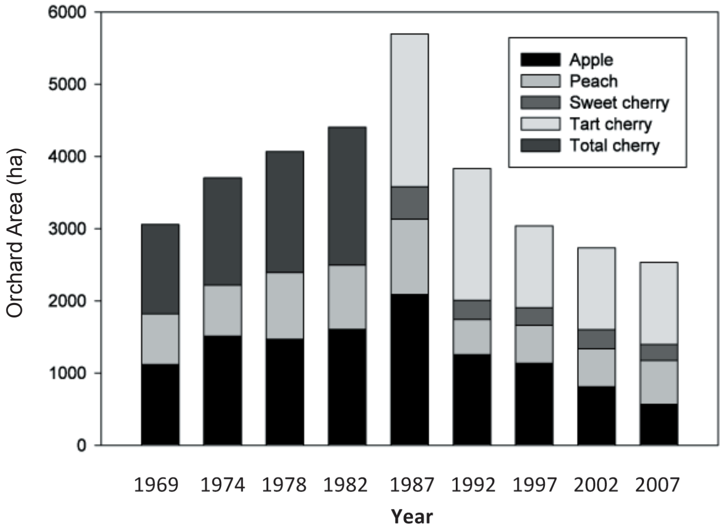

Figure 1. Total Utah orchard area for apple, peach, sweet and tart cherry. Data are from Census of Agriculture reports (9). Prior to 1987, sweet and tart cherry acreage were not reported separately.

including the Alar controversy in 1989, increased foreign competition, and general loss of farmland to urban development.

Peach production area also increased from 1969 to 1987, reaching a peak of 1042 ha. Production area then declined to 405 ha in 1993, and has since increased to 607 ha in 2009. Sweet cherry production area has been decreasing ≈7.1% annually since 1969, reaching 203 ha in 2009. Some of the recent drop in sweet cherry area has been due to urban development on the best orchard sites. Many of the remaining orchard sites are more frost prone, making sweet cherry production less consistent, and less economically viable.

With the decline in apple acreage, and higher tolerance to fluctuating spring temperatures, tart cherry has recently become the state's most important fruit crop, with Utah ranking second behind Michigan in total tart cherry production. Tart cherry production is highly mechanized, and essentially all of the fruit is frozen for processing. Since the focus of this paper is on local marketing of fresh product, statistics on tart cherry acreage, production and consumption are not included in the following analyses.

Yields

Trends in fruit crop yields ($kg \cdot ha^{-1}$) are difficult to determine, because annual fluctuations exceed any apparent trend. These yield fluctuations are likely due to a combination of factors. The majority of Utah's commercial orchards are located in a relatively small geographic area, at elevations ranging from 1370 to 1550 m. This arid high-elevation area is prone to large diurnal temperature fluctuations in the spring, resulting in frequent loss of flower buds and blossoms to spring frosts. Regional frost events often affect a large portion of this primary fruit production region. In the case of apple, these frost events also synchronize biennial bearing.

Apple production technology and orchard management skills have improved significantly in the last 40 years. Many growers have moved to high density plantings on dwarfing rootstocks. However, some fruit growers have been much less aggressive in moving to modern systems, and continue to maintain old, lower-productivity orchards. Regression analysis showed no significant change (P = 0.93; $R^2 = 0.0066$) in apple yields from 1969 to 2009. However, any possible changes

Table 2. National trends in per capita consumption (10) and Utah state trends in total production (9) and consumption (10). The assumption is that Utah per capita consumption is the same as the USA average.

Crop	Regression equation	R^2	*P*-value	Peak	Recent trend
Per capita consumption					
Apple	$Y = -0.0036x^2 + 14.5x - 14424$	0.44	<0.0001	1989	Decreasing
Peach	$Y = 0.0034x^2 - 13.58x + 13560$	0.32	0.0009	1990	Decreasing
Sweet Cherry	$Y = 0.0005x^2 - 1.92x + 1906$	0.53	<0.0001	---	Increasing
Total Utah production					
Apple	$y = -0.0319x^2 + 126.69x - 125738.19$	0.42	<0.0001	1985	Decreasing
Peach	$y = 0.0034x^2 - 13.58x + 13559.76$	0.22	0.0097	---	Increasing
Sweet Cherry	$y = -0.074x + 148.94$	0.38	<0.0001	---	Decreasing
Total Utah consumption					
Apple	$y = 0.33x - 632.53$	0.94	<0.0001	---	Increasing
Peach	$y = -0.002x^2 + 7.96x - 7996$	0.83	<0.0001	>2009	Increasing
Sweet Cherry	$y = 0.0013x^2 - 5.09x + 5043$	0.79	<0.0001	---	Increasing

may have been masked by the large annual fluctuations due to freeze cycles and biennial bearing. Further, the lack of change may also be due to the mix of modern, high-density orchards and old, less-productive orchards.

Average sweet cherry yields showed equally variable results from year to year. Likewise, regression analysis showed no significant relationship between yield and time over the past 40 years. Modern sweet cherry orchards are also planted in higher densities, though not to the extent of apple or peach. Sweet cherry showed annual fluctuations similar to that of apple, with no detectable trend in per-hectare yields ($P = 011$; $R^2 = 0.18$).

Peach yields also showed significant annual fluctuation, but showed a significant curvilinear trend over the past 40 years ($P = 0.028$; $R^2 = 0.268$). The fitted regression curve ($y = 7.9x^2 - 31510x + 3134058$) indicated that yields have been increasing in recent years. Although older, less-productive peach orchards remain, many growers have moved to higher density orchards with quad-V training systems to improve crop yields.

Production totals

Production totals for the individual crops closely match the fluctuations in producing hectares. Statewide apple production ranged from 1.81 million kg in 1972 to a high of 30.9 million kg in 1987. Trend analysis predicted peak annual production in 1985 (Table 2).

Total peach production in the state ranged from a high of 8.18 million kg in 1976 to a low of 0.77 million kg in 1972. Quadratic trend analysis indicates that total peach production declined from 1969 to 1997 but has begun to rise in recent years to 4.54 million kg in 2009 (Table 2). Trend analysis of total Utah sweet cherry production shows that production has declined linearly since 1969 (Table 2).

The extremely low production of peaches in 1991; tart cherries, sweet cherries, and apples in 1971 and 2002; and sweet cherries in 2008 (Figures 2 to 4) are particularly noteworthy. Late spring fronts damaged flowers and reduced production in each of those years, nearly eliminating entire crops. General annual fluctuations are also apparent and can be attributed to smaller scale frost events that damaged part of the crop.

Statewide consumption

Although per capita consumption of apples and peaches has declined in recent years, the rapid population growth in Utah (Table 1) resulted in net increases in total statewide

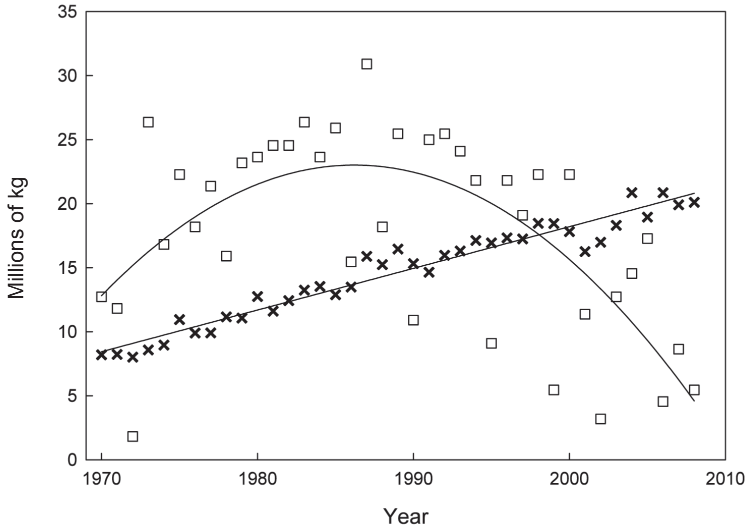

Figure 2. Trends in total statewide apple production (□) and consumption (×). Regression equations are shown in Table 2. Trend analysis indicates that Utah became a net importer of apples in 1997.

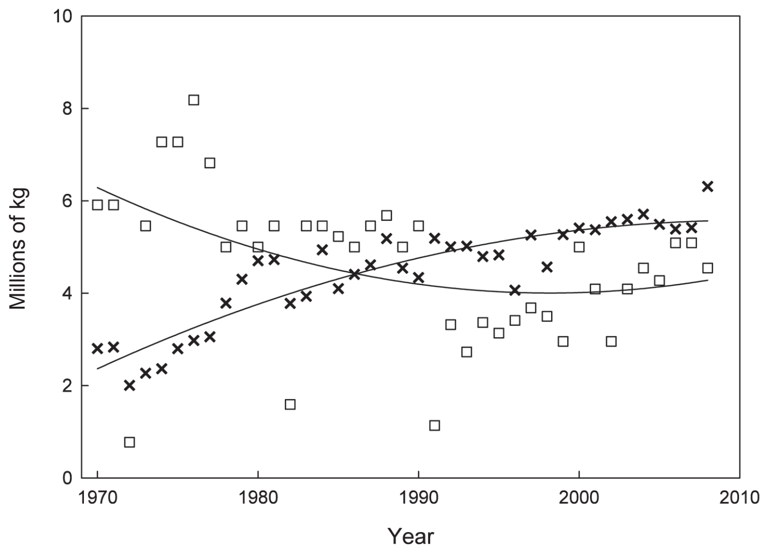

Figure 3. Trends in total statewide peach production (□) and consumption (×). Regression equations are shown in Table 2. Trend analysis indicates that Utah became a net importer of peaches in 1987.

consumption of both crops. Statewide consumption of sweet cherries is increasing more rapidly than peach or apple (Table 2), due to increases in both population and per capita consumption.

Net exports

Based on trends in production and statewide consumption (population × per capita consumption), Utah became a net importer of apples in 1997 (Figure 2). In order for Utah producers to recapture 100% of the local market at current average yields, production area would need to increase by 800 ha, a 60% increase. Alternatively, average yields, would need to increase to 21.0 Mg•ha^{-1}. In 2005, statewide average yields were 26.7 Mg•ha^{-1}. If this productivity were maintained across all apple orchards, 100% of total demands could be met. A more aggressive program of replacing old orchards with modern, high-density orchards could increase average annual yields per hectare.

From 1969 to 1987 total peach production decreased more rapidly than the population increased. As a result, Utah became a net importer of peaches in 1987 (Figure 3). However, since 1997 total statewide peach production has been increasing due to an increase in the production area (608 ha) and improved yields (Table 2). An additional 120 ha of producing orchards or a 16% increase in yields would meet current statewide demand.

Sweet cherry production has steadily decreased since 1969 while total consumption has increased. Trends indicate that Utah became a net sweet cherry importer in 2005 (Figure 4). To maintain local market share, producers will need to maintain or increase the producing sweet cherry hectares or move to a more aggressive program of orchard renewal and to more efficient orchard management systems on the most suitable orchard sites.

Conclusion

With continued increases in Utah's population and the growing local-food movement, demand for local fruit will continue to increase. For Utah growers to recapture local markets there needs to be an increase in production area, an increase in yields per hectare, or a combination of both. However, pressure from urban development in prime fruit growing regions is making expansion of the fruit production area economically unviable. Irrigation water is also being diverted for urban and suburban use, further limiting the amount of water available for agricultural production. Without more aggressive preservation of land for orchard use and greater allocation of water for food production, maintaining the existing orchard area will be challenging. Improving yields

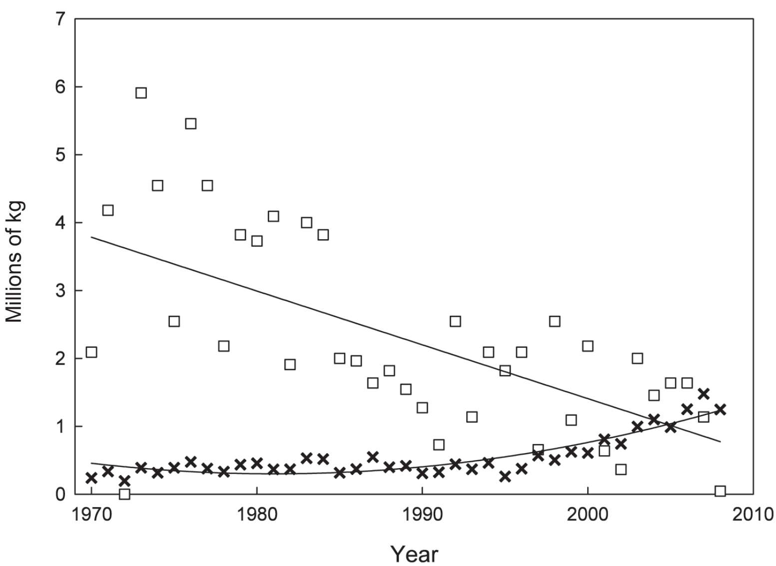

Figure 4. Trends in total statewide sweet cherry production (□) and consumption (×). Regression equations are shown in Table 2. Trend analysis indicates that Utah became a net importer of sweet cherries in 2005.

through increased orchard management skill and improved fruit production technology will be the primary avenues for growers to meet the increasing demand for local fresh fruit.

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S-RNase genotypes of apple (*Malus × domestica* Borkh.) including new cultivars, lineages, and triploid progenies

We have determined the *S-RNase* genotypes of 33 new apple cultivars and lineages produced in Japan, 44 unknown cultivars and two lineages, and 22 triploid progenies. We have speculated on the putative parentage of new cultivars and lineages based on their *S-RNase* genotypes and also identified mistaken parents. In the case of the triploid progenies, the breeding of new cultivars using a triploid paternal parent may pose problems due to its low pollen viability. Nevertheless, diploid and triploid progenies were obtained using a triploid maternal parent. We have compiled a database of 516 apple *S-RNase* genotypes, including those previously investigated, which included a survey system for cultivar combinations, showing those that were fully-incompatible, semi-compatible, or fully-compatible, together with information on the PCR-RFLP method used for the identification of *S-RNase* genotypes and *S-RNase* allele designation (available at http://www.agr.nagoya-u.ac.jp/~hort/apple/). Abstract from S. Matsumoto et al., 2011. Journal of Horticultural Science and Technology 86(6): 654-660.