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FRUIT CONSUMPTION, DIETARY GUIDELINES, AND AGRICULTURAL PRODUCTION IN NEW YORK STATE -- IMPLICATIONS FOR LOCAL FOOD ECONOMIES

by

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ABSTRACT

Consuming locally produced foods offers many benefits to consumers, producers and the environment. As a result, local food economies are gaining attention as a means for boosting agriculture and food production in New York State. Concurrent with this interest in local agriculture is a national concern over the health effects of American food consumption patterns and the capacity of agriculture to support nutritious diets. This study merges these areas of inquiry in the context of a nutritionally and economically important agricultural sector, namely New York State fruit production.

Three questions are examined in this research. 1) How does New York State fruit production compare with fruit consumption by New Yorkers? 2) How do production and consumption of fruit compare with the recommendations of the U.S. Department of Agriculture food guide pyramid? 3) What implications do these comparisons have for New York State agriculture? These questions were addressed using existing national and state data and valuable methods borrowed from recent USDA Economic Research Service analyses.

Annual per capita consumption estimates for the Northeast suggest that New Yorkers consume approximately 180 pounds of fruit per person per year. Based on population estimates, this level of consumption indicates that New Yorkers ate 3.2 billion pounds of fruit in calendar year 1999. In contrast, New York State agriculture harvested an average of 1.5 billion pounds of fruit annually during 1994-1998. After adjusting for processing conversions, post-harvest losses, and inedible portions, the consumable equivalent of this production is 816 million pounds. Furthermore, a commodity-by-commodity comparison indicates that New York produces three products (e.g. fresh apples, processed apples, and processed cherries) in quantities that exceed the estimated in-state demand. As a result, New York produces enough fruit to provide 18 percent of the total fruit consumption plus 256 million pounds of "surplus" of the aforementioned three commodities.

Comparisons with the Food Guide Pyramid demonstrate that though fruit consumption in the Northeast is higher than the national average, intake is still well below the recommendations. At 1.9 servings per person per day, fruit consumption would need to increase by 63% to reach the average recommended per capita intake for New York State. The disposition of current consumption is consistent with the Pyramid recommendation that intake be split evenly between the Vitamin C-rich "citrus, melons and berries" and the catch-all category "other fruit". However, current dietary preferences may not satisfy the

Pyramid suggestion that consumers choose whole fruits most often since juices comprise more than a third of all fruit servings. New York growers harvest enough fruit to provide 20% of this recommended intake, but production is not evenly distributed between the two subgroups. Almost all in-state production lies in the "other fruits" category (e.g. apples, grapes, and pears) while the production of melons and berries is insignificant relative to the recommended intake.

The results of this research suggest both opportunities and challenges for New York State fruit growers and consumers. For most fruits, the in-state market is large relative to current production. In addition, consumption of fruit needs to increase substantially to meet national nutritional goals. Taken together, these findings suggest potential for marketing more fruit, and more New York grown fruit, to New Yorkers. However, the length of the growing season and the predominance of just two crops, apples and grapes, bring into question the ability of New York's fruit sector to provide the diversity needed to supply a more significant share of the state's consumption. Moreover, current food preferences may limit sales of in-state produced fruit as over 60% of consumption comes from crops that cannot be grown in New York's temperate climate. Despite these conflicting patterns, potential exists for growers to target local and regional markets, particularly if they can entice the palates of nutritionally conscious consumers.

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INTRODUCTION

This report is the second of a series developed to describe and analyze the correlation between food consumption, dietary guidelines and agricultural production in New York State. The first report focused on vegetable consumption and production (Peters, *et al*., 2002). In this report we continue the analysis by concentrating on fruit production and consumption. To the extent feasible, the approach to this analysis is consistent with our earlier work, allowing for comparisons between food groups.

The motivation for this report is identical to that of our work with vegetable commodities. Greater connectedness between local food production and local food consumption is seen as a potential means to boost the agricultural economy and improve the diets of consumers. On the producer side, such linkages offer possibilities for job creation in the production and value-added segments of the food system while retaining, or perhaps expanding, the level and diversity of agricultural production. On the consumer side, such linkages offer New Yorkers encouragement to improve their personal nutrition by enjoying the fresh fruits and vegetables raised in the local area. In light of the sluggish upstate economy, ailing rural communities, and the national problem of diet-related chronic diseases, local food economies may provide a welcome opportunity for synergy.

Unfortunately, very little evidence is available to assess the potential for expanding local markets and building stronger producer-consumer networks. In-state production of major farm and food commodities can be described with great accuracy, but marketing channels for New York's crops and animal products are not known with certainty. One cannot readily access uniform and comprehensive comparisons of sales in offshore international markets and sales into domestic outlets, either within or outside of any individual state. The food-purchasing behavior of New York consumers is only understood in a general way. Data on food consumption exists in the aggregate, but very little information is

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available on a regional basis. As a result, it is difficult to associate in-state production of agricultural products with in-state consumption of those products.

Reflective of these data gaps, the discussion of food consumption issues and agricultural production issues for the State is disconnected and proceeds in separate tracks. Conventional wisdom develops to fill the information vacuum, and unsubstantiated claims and speculations abound. The debate over appropriate state and local farm and food policy is largely fueled by anecdotal evidence or based on inference, without the necessary supporting data to reveal important patterns and develop a clear strategy. The search for steps that might be needed to retain and expand income and employment for New York farm and food system businesses, while at the same time securing a safer and more nutritious food supply for New Yorkers, is thus hampered.

In this report we continue the work begun earlier and continue an inquiry into the relationship between in-state food consumption, in-state agricultural production, and current recommendations for a healthy diet. As before, we examine three questions: 1) How does New York State fruit production compare with fruit consumption by New Yorkers? 2) How does the consumption of fruit by New Yorkers compare with recommendations in the USDA Food Guide Pyramid? 3) What are the implications for New York State agriculture? This report is organized into several sections. Below we look at current fruit consumption trends versus dietary recommendations and production trends in New York agriculture. The methodology for the study and the research results are presented in the Methods and the Results sections. Finally, a Discussion section deals with the possible ramifications of the study for the fruit industry and for local food economies.

Recommendations for Fruit Intake and the Health Rationale for Fruit Consumption

There is abundant evidence that regular consumption of fruits, vegetables and whole grains is associated with reduced risks of chronic diseases, such as heart disease and several forms of cancer. In addition to being valuable sources of fiber, these "plant foods" and products made from them are rich sources of essential nutrients and a variety of phytochemicals such as phenolics and flavonoids that provide health benefits.

Every five years since 1980, the United States Department of Agriculture (USDA) and the United States Department of Health and Human Services (DHHS) have jointly published a revised version of *Nutrition and Your Health: Dietary Guidelines for Americans* (Davis and Saltos, 1999). The Dietary Guidelines have been relatively consistent since 1980, emphasizing seven distinct guidelines for health improvement and disease prevention. The fifth and most recent edition, as shown in Figure 1, contains ten dietary guidelines that are organized around three broad diet and health principles – aim for fitness; build a healthy base; choose sensibly (USDA and DHHS, 2000).

Figure 1. Dietary guidelines for Americans

AIM FOR FITNESS

- Aim for a healthy weight.
- Be physically active each day.

BUILD A HEALTHY BASE

- Let the Pyramid guide your food choices.
- Choose a variety of grains daily, especially whole grains.
- Choose a variety of fruits and vegetables daily.
- Keep food safe to eat.

CHOOSE SENSIBLY

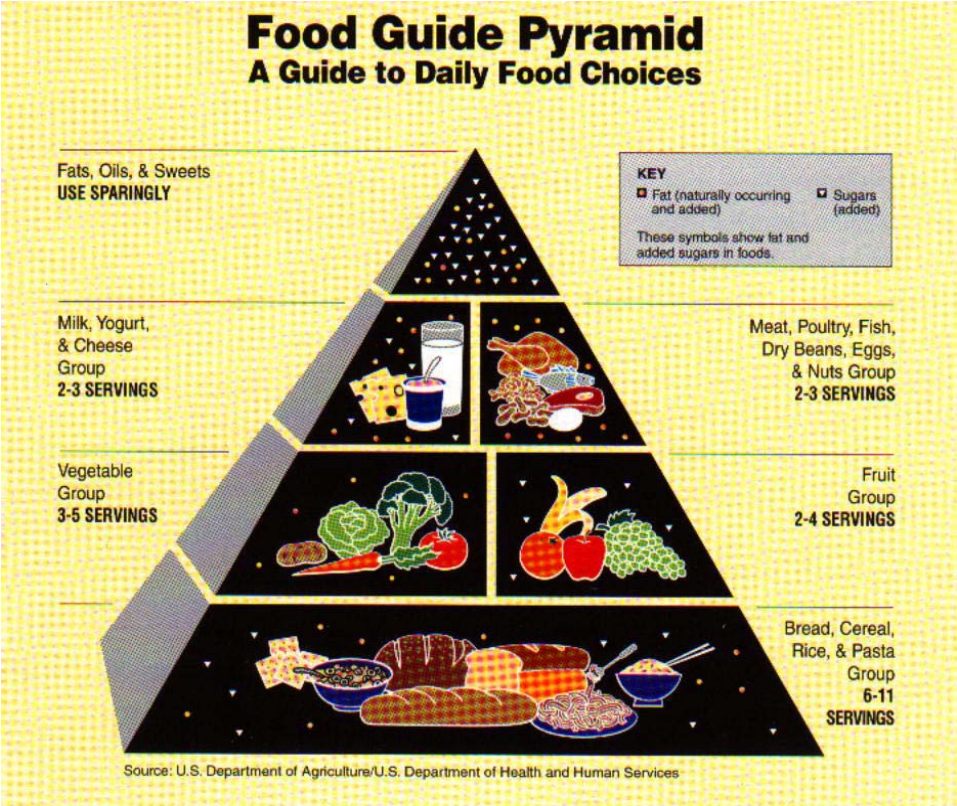
- Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.
- Choose beverages and foods to moderate your intake of sugars.
- Choose and prepare foods with less salt.
- If you drink alcoholic beverages, do so in moderation.

Sources: US Department of Agriculture and US Department of Health and Human Services, 2000.

The guideline having to do with fruit provides general advice to "choose a variety of fruits and vegetables daily." The Food Guide Pyramid (1995), introduced with the fourth (1995) edition of the Dietary Guidelines, serves as the nutrition education implementation strategy of the dietary guidelines. This food guide replaced the Basic Four Food Groups, first proposed in 1958 in a USDA publication titled *Food for Fitness – A Daily Food Guide* (USDA, 1977). The Food Guide Pyramid and its precursor (as well as earlier food guides) were based on the concept of selecting from different food groups and maintaining a balance between the proportion of micronutrient-dense foods and energy-yielding foods (Frankle and Owen, 1993). Such guides are useful because they provide a quantitative measure for which to strive in order to meet the more generally articulated guidelines. "A food guide translates recommendations on nutrient intake into recommendations on food intakes. It provides a conceptual framework for selecting the kinds and amounts of foods of various types which together provide a nutritionally satisfactory diet" (Welsh *et al*., 1992).

The USDA Food Guide Pyramid (Figure 2) divides food into five major groups (grains, vegetables, fruits, dairy, and protein-rich foods) and a sixth group of foods that should be consumed in moderation (added fats and sugars). The Pyramid suggests the quantities of food that should be eaten from each of these major groups as well as the limits for consumption of added fats and sugars. These recommendations are expressed as servings of food (e.g., a medium-sized carrot, a cup of lettuce) rather than by weight. Expressing the recommendations in such everyday measures is meant to facilitate adherence to the Food Guide Pyramid guidelines.

Figure 2. USDA Food Guide Pyramid



Sources: US Department of Agriculture and US Department of Health and Human Services, 2000.

The Food Guide Pyramid recommends a range of servings for each food group. For fruit the recommendation is two to four servings daily. This range is intended to assist individuals in consuming foods in proportion to their energy requirements. People with a low caloric need should consume at the low end of the range while those with a high caloric need should consume at the high end of the range. The Pyramid defines low, medium, and high calorie diets as approximately 1600, 2200, and 2800 calories per day.

The design of the Pyramid conveys the importance of plant foods in a healthful diet. Foods from the grain products group, along with vegetables and fruits, are the basis of healthful diets. These plant foods are emphasized because they are rich sources of vitamins, minerals, complex carbohydrates (starch and dietary fiber), and other substances that are important for health. Plant foods are also generally low in fat. Foods within the same group have different combinations of nutrients and other beneficial substances. For example, some vegetables and fruits are good sources of vitamin C or vitamin A, while others are high in folate; still others are good sources of calcium or iron. Thus, the Dietary Guidelines, in recommending a variety of foods within and across food groups, assure an adequate intake of essential and protective nutrients. This area has become a subject of national research with the discovery of compounds known as phytochemicals which are thought to be protective against certain cancers and other chronic disease.

Phytochemicals represent a broad class of protection compounds which have been identified in many plant foods. Fruits and vegetables are particularly rich sources of phytochemicals and contain a variety of these compounds including flavonoids and phenolics. Through the "anti-oxidant" activity of phytochemicals, these compounds provide important health benefits, particularly in relation to reducing the risk of major chronic diseases such as cancer and cardio-vascular disease. An ample intake of phytochemicals is believed to prevent the "free radical induced oxidative stress associated with several cellular toxic processes including oxidation damage to protein and DNA, membrane lipid oxidation, enzyme inactivation, and gene mutation that may lead to carcinogenesis" (Poulsen, 1998). While in vitro, in vivo, and epidemiological studies support this connection between phytochemicals and reduction in oxidative damage, no requirement levels have been established for these protective compounds.

The antioxidant and antiproliferative activities of phytochemicals in fruits is currently an active area of research. Liu *et al.* (2002) have described the phenolic, flavonoid, and anthocyanin contents in several varieties of raspberries. The antioxidant and antiproliferative activity of phytochemicals in New York apples has also been examined (Liu *et al*., 2001; Eberhardt *et al*., 2000; Wolfe, 2003; and Sun, 2002).

Fruit Consumption Trends

Americans have access to an abundant, highly varied and, for most, a very affordable food supply that should facilitate adherence to the dietary guidelines. Yet, only a small fraction of the US population consumes the recommended number of servings from each of the major food groups (Krebs-Smith *et al*., 1996; Munoz *et al*., 1997).

Most Americans of all ages eat fewer than the recommended number of servings of grain products, vegetables, and fruits (Tippet and Cleveland, 1999), and fewer than 20% of children in the US are consuming the recommended 5 servings of fruits and vegetables per day, a significant concern due to the likelihood of childhood dietary habits continuing into adulthood (Krebs-Smith *et al*., 1996; Kennedy and Goldberg, 1995; Baranowski *et al*., 1997; Dennison at al., 1998). These discrepancies between consumption levels and dietary recommendations represent major public health concerns given the association of diets low in fruits and vegetables with an increased incidence of obesity, heart disease, lung disease and diabetes and certain types of cancer (Ziegler *et al*., 1996).

McNamara *et al*. (1999) conducted a review of how Americans were eating relative to federal dietary recommendations and quantified discrepancies (or "gaps") between consumption, dietary recommendations, and the food supply. They projected those gaps to the year 2020 based on demographic changes estimated by the US Census Bureau. The authors then considered how full compliance with the recommendations in the Food Guide Pyramid would impact aggregate food supplies in the near and long term. The rationale behind their analysis is that, socio-cultural and behavioral factors not withstanding, successful adoption of the dietary guidelines "also requires that sufficient quantities of healthful foods be available in the market" (McNamara *et al*., 1999).

According to their analysis, if consumers were to immediately meet the Food Guide Pyramid recommendations for fruit, the supply would need to increase by more than one-and-a half times the 1994 supply level. McNamara *et al*. suggest that in order to satisfy such an increased demand for these foods, the food supply would need to be augmented through modest increases in domestic production but largely through expanded imports. In a comparison of the US food supply and Food Guide Pyramid recommendations, Kantor (1999) estimates that average fruit intake is 1.3 servings per day compared to the midpoint of the recommended range of 3 servings a day. To put this gap in perspective, note that "While fruit consumption has increased nearly 20 percent between 1970 and 1996, this translates to an increase of about one-fifth of a serving" (Kantor, 1999, p. 77).

Young and Kantor (1999) estimated adjustments in crop acreage that could occur to meet changes in food demand if the American diet became more consistent with Food Guide Pyramid recommendations. They estimated that on balance a total of 5.6 million additional acres would need to be put into production. They noted that although this is a small overall change (about 2 percent of the average area of US cropland planted in 1991-1995), more significant acreage changes could be anticipated for certain commodity groups. Planted area of fruits, for example, would need to increase by 4.2 million acres, a 124% increase from the 1991-95 acreage. They also stress that, because of land and climatic differences, adjustments for some commodities may be concentrated in certain regions.

Food Production Trends in New York State

The number of farms and farm acreage peaked in New York in the early 1900s (see Table 1) (NYS Census of Agriculture), but sharp declines in farms, land in farms, and cropland occurred during the 1920s and 1930s. At the close of World War II, there were about 125,000 farms in New York State. Since that time, farm consolidation has dominated the rural landscape of the state as the farming industry reacted to increased production potential, new cost-price relationships, economic opportunities on and off the farm, and shifting social realities. As a result, farm numbers have continued to decline over the last fifty years. In 1992, the Census counted about 32,000 farms. The number of farms in New York remained relatively stable in the 1990s with farm businesses continuing to be consolidated into larger economic units, while smaller part-time farms were increasing in number. Today, more than 40 percent of all New York farms can be classified as residential farms because the operator also has a full-time job off the farm (USDA, 1999).

Table 1. Farm numbers, land in farms, and improved land in New York State, census data, 1910-1997

Census Year	Farm Numbers	Land in Farms	Improved Land or Total Cropland*
		--- million acres ---	
1910	215,600	22.0	14.8
1920	193,200	20.6	13.2
1930	159,800	18.0	10.5
1940	153,200	17.2	10.2
1950	124,800	16.0	8.5
1960	82,400	13.5	7.1
1970	51,900	10.1	6.1
1978	43,100	9.5	5.9
1987	37,700	8.4	5.4
1992	32,300	7.5	4.9
1997	31,757	7.3	4.7

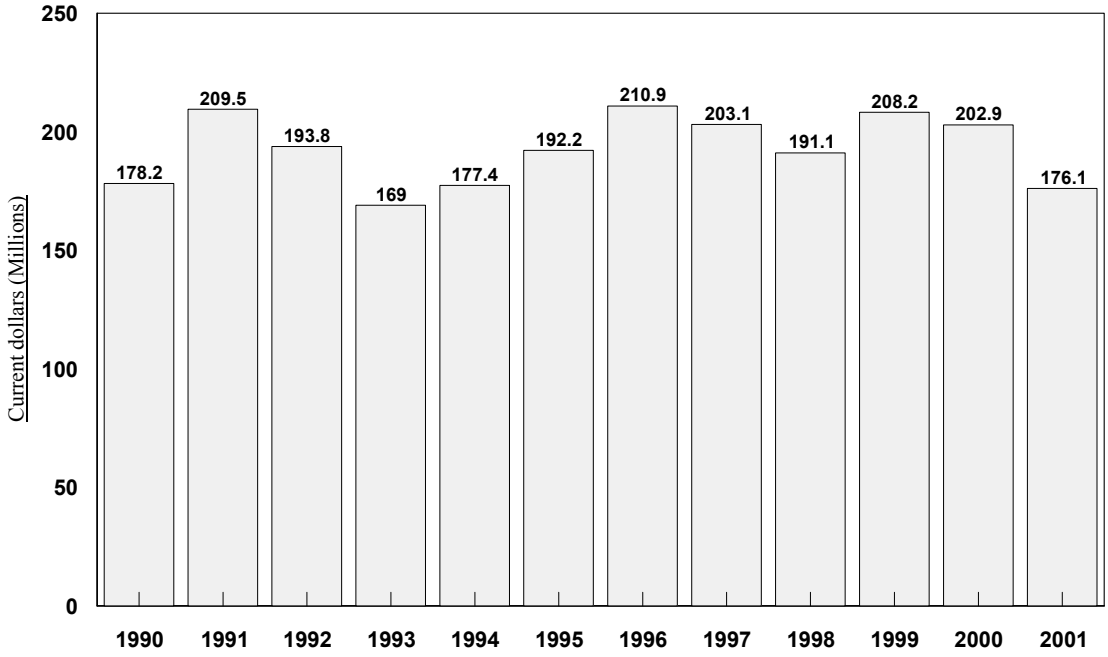
* Improved land is all land from which crops were harvested including pasture from which hay could have been harvested. Cropland was substituted for "improved land" in the Census of Agriculture in 1925.

Source: Stanton and Bills, 1996.

Likewise, total acres in agriculture declined over the past century. Farm consolidation, expanded competition for land from nonfarm uses, and the removal of marginal lands from agricultural production have resulted in continual decreases in farm acreage. Land in farms decreased from 16 million acres in 1950 to just over 7 million acres in the late 1990s. The amount of forested land increased from 11.7 million acres in 1950 to 16.3 million acres in 1992 through the reversion of idled farmland to forest cover (Stanton and Bills, 1996; Bills and Stanton, 1999). The remaining acreage has been converted to residential, commercial, and transportation uses.

However, farm and farm acreage losses have not translated into decreases in farm output due to significant gains in crop yields and labor productivity. The value of farm output, both in current and real (price adjusted) dollar terms, has increased systematically since the 1950s. Today, about two-thirds of all farm cash receipts are accounted for by livestock and livestock products; fluid milk sales alone are 56 percent of total receipts (NYASS, 2002). Fruit crops, the focus of this study, amount to about 7 percent of total cash receipts; receipts from fruit production have fluctuated around a mean value of about $193 million during the last decade with no obvious upward or downward trend (Figure 3).

Figure 3. Total cash receipts from fruit crops, New York, 1990-2001



Source: NYASS, 2001; NYASS, 2002.

More Production to Meet In-State Food Needs

Several factors inherent to New York State and the northeastern US would seem to indicate a potential for increased reliance on local food sources. Despite the pressures that population density has placed on farmland for other uses, the fact that we have nearly 60 million "eaters" in the Northeast, many of them concentrated in densely populated areas, provides an opportunity for local food producers to supply these regions of concentrated demand. The Northeast is home to some of the largest cities in the world, and many city and metropolitan residents have financial resources to support agriculture in the local area and a growing interest in doing so.

The population in the Northeast is also increasingly diverse. By 2010, it is estimated that New York, for example, will have no ethnic majority. This diversity in population presents an opportunity for our food and agriculture system. Today's immigrants, as well as those who arrived decades ago, play an important role in agricultural development in the United States. Immigrants represent a strong force for shaping culinary preferences, developing niche markets, and expanding agricultural diversity (Walz, 2000; Kotkin, 2001).

Not only is our regional population diverse culturally, it is also diverse economically. Many residents of New York State suffer from persistent food insecurity. According to recent estimates from the USDA Economic Research Service, 9.6 percent of households in New York are not food secure (Nord *et al*., 2002). Though local foods are often

associated with more affluent consumers, some of the most effective long-term strategies for alleviating food insecurity are consistent with the development of sustainable, local food systems. For example, the Women, Infants, and Children (WIC) Farmers' Market Nutrition Program (FMNP) was established in 1992 for the dual purpose of providing fresh fruits and vegetables to women, infants and children who are nutritionally at risk and expanding consumer awareness of farmers' markets (USDA Food and Nutrition Service, 2002).

While rarely considered to be the nation's "breadbasket", the Northeast is well suited to the production of a wide variety, and perhaps an even greater quantity, of foods needed to more closely match the food requirements and food preferences of Northeasterners. While a short growing season in the region is a limitation to fruit growers who desire more contact with local consumers, other factors favor production in the region. The Northeast has pockets of superb soils and ample water resources. In contrast, California, which dominates the production of fruits and vegetables in the US, is dependent on a highly subsidized but limited supply of water for agricultural uses. As competition for water resources increases in California and costs mandated by dependence on fossil fuels for long distance shipping become less sustainable, the advantages of relying on local agriculture for more of our food, especially crops with significant water weight (like fruit) will become more apparent (Duxbury and Welch, 1999). Finally, in the minds of our region's farmers, non-governmental organizations (NGOs), researchers and extension agents, there resides an abundance of intelligence about appropriate farming and marketing methods that can be harnessed and directed toward the goal of achieving more reliance on local food systems

METHODS

Secondary national and state data were employed to make comparisons among New York State fruit production, New York State fruit consumption, and the Food Guide Pyramid guidelines. Our first question, "How does current fruit consumption contrast with current production?" was addressed on a crop-by-crop basis using estimates of fruit consumption for the entire state. Our second question, "How do consumption and production compare with the Food Guide Pyramid recommendations?" was approached by comparing the quantities of fruit grown and consumed in New York State with the estimated amounts that would be needed if the diets of all New Yorkers were consistent with the Food Guide Pyramid recommendations.

Fruit Consumption Data

Estimating food consumption for a single state is not a straightforward procedure; there are no surveys of food consumed in individual states, nor is there any tracking of food across state borders. Instead, food supply accounting and comprehensive food con-

sumption surveys are done only at the multi-state and national levels. Thus, the researcher must rely on aggregate national or regional per capita consumption estimates that are assumed to roughly approximate the food consumption within a single state.

Two general types of consumption data are available. Food supply data (also referred to as food disappearance) estimate the amount of food that enters the US food system. The USDA Economic Research Service (ERS) calculates these estimates annually using a balance sheet approach that accounts for domestic production, imports, exports, and beginning and ending stocks of primary foodstuffs. National survey data estimate actual consumption by interviewing a representative sample of the United States population to find out what each participant ate over a 24-hour period. These national surveys are intensive, and the USDA Agricultural Research Service (ARS) conducts them only periodically. Three such surveys have been conducted since the late 1970s.

For this study, national survey data from the Food Commodity Intake Database (FCID) were used to estimate per capita consumption of fruit in New York. The FCID data were recently released in electronic format by the US Environmental Protection Agency (EPA) and the USDA Agricultural Research Service (ARS) for the purpose of estimating human exposure to pesticide residues through foods. This database was constructed using information gathered in the 1994-1996 Continuing Survey of Food Intake by Individuals (CSFII)[1] plus a supplemental survey of children (ages 9 and younger) conducted in 1998 (EPA and ARS, 2000b). The food consumption data from these CSFII surveys were converted into consumption of constituent food commodities in grams per kilogram bodyweight.

Though the FCID provides little original data, several features make it useful for this study and preferable to the CSFII and the national food supply statistics. First, the groupings used in the FCID for fruits are taxonomically more similar to agricultural commodity groups regularly reported in state/Federal fruit production statistics than are the groupings used in the CSFII. This facilitated comparisons of food consumption with agricultural production. Second, data for each survey participant are coded by census region, making it possible to compile food consumption estimates for the Northeastern, Midwestern, Southern, and Western US. Because New York State comprises such a large share of the population of the Northeast[2], we assume that food consumption in New York can be more accurately represented by regional, rather than national, consumption estimates. Lastly, the FCID reports estimates of intake of 548 different commodities, including many minor or micro crops that are not described in the US food supply data.

In the currently available version of the FCID (version 2.1), the data have not been summarized. The database contains all individual consumption estimates for each survey

[1] The CSFII is the national survey conducted by the USDA Agricultural Research Service to provide information on the kind and amount of foods that Americans consume (USDA, 1998).

[2] The Northeast region consists of the following states: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

participant, and it is up to the user to perform the desired summaries[3]. For this study, it was necessary to calculate average per capita consumption of a commodity, and the form in which it was consumed (fresh or processed), from the FCID. This is accomplished through a two-step process. First, consumption estimates are converted from units of grams per kilogram bodyweight to grams per person. Second, a weighted average of all observations is taken using the sample weights assigned to each participant. This was accomplished using the formula shown below.[4].

$$C_{ij} = [\sum (I_{ijk} \times BW_k \times SW_k)] / SW_t$$

Where:

C_{ij} = daily per capita consumption of food commodity "i", form "j" in the population of interest

I_{ij} = intake of commodity "i", form "j" (in grams of food per kg bodyweight) by the "k^{th}" individual surveyed from the population of interest

BW_k = the bodyweight (in kilograms) of survey individual "k"

SW_k = the sampling weight of survey individual "k"

SW_t = the total sampling weight for the population of interest.

Because the FCID was derived from 24-hour recall data, it estimates consumption per day. Annual per capita consumption was extrapolated by multiplying the daily estimates by 365. These average annual per capita consumption estimates were tabulated for both the Northeast region and the entire US. Estimates for the Northeast are assumed to be representative of annual per capita consumption in New York State. Both US and Northeast per capita consumption estimates are shown in Appendix 1.

Fruit Production Data

Two core databases for agricultural production data for New York State are published by the USDA. These are the New York Agricultural Statistics Service (NYASS) annual reports and the Census of Agriculture. The methods of data collection for these sources are different, and each has its strengths and weaknesses.

NYASS uses both list and area frame statistical designs to generate estimates of farm gate production. These estimates are reported on an annual basis, providing a reliable source of time-series data. The major weakness associated with this data source is that it provides estimates for principal crops (in terms of harvested acreage and field edge value), rather than an exhaustive list of fruit crops. Fruit crops which involve fewer acres and/or small total farm gate value are not included in this data source. Furthermore, the list of

[3] The FCID includes extensive documentation to assist the user in properly using the information contained in the database.

[4] This formula was derived with the help of Dr. Edward Frongillo, Division of Nutritional Sciences, Cornell University.

principal fruit crops is periodically adjusted by the USDA to stay within budget limits and to adjust to changing conditions in the field, thereby changing the comparative data.

The Census of Agriculture is conducted at 5-year intervals by mailing a questionnaire to individuals and corporations thought to operate a farm or a ranch. The Census, now conducted by the USDA, contains coverage biases and consequently underreports farm numbers, farmland, and farm commodity production. The advantage of the Census is that it covers a wider array of crops and animals than does the NYASS data.

In order to avoid underreporting production and overlooking minor crops, fruit production at the state level was estimated using both data sources. When data were available for a commodity in NYASS, the production estimates from that publication were used. When data were not available in NYASS, estimates from the Census of Agriculture were used.

Food Guide Pyramid Recommendations

As described in the Introduction, the USDA Food Guide Pyramid provides recommendations for food intake from each food group based on an *individual's* daily caloric needs. To compare the average per capita consumption of a *population* with these recommendations, it is necessary to estimate the average number of servings required per capita within that population. This was accomplished using demographic data for New York State and estimates of the appropriate number of Pyramid servings for individual age/gender cohorts. Estimates of the daily number of vegetable servings required by members of various age/gender cohorts were obtained from a description of the Healthy Eating Index (HEI), a device developed by the USDA Center for Nutrition Policy and Promotion (CNPP) to measure compliance with the Dietary Guidelines. (Bowman *et al*., 1998). These estimates are based on the average caloric requirements of each age/gender group and the recommended number of Food Guide Pyramid servings at such levels of energy intake. They are reported by Bowman and others (1998, p.5). Serving recommendations for fruit are shown below in Appendix 6.

Demographic data from the US Bureau of the Census were used to estimate the population of each age/gender cohort in New York State (US Dept. Commerce, 1999) These population estimates were multiplied by the servings recommendations for their respective age-gender cohorts to estimate the number of servings required by each cohort. The cohort totals were summed and an average taken to estimate the average number of vegetable servings recommended per person. The results of these calculations are displayed in Appendix 6.

In addition to the recommendation for the daily number of fruit servings, it has been suggested (Cronin *et al*., 1987) that fruit consumption be evenly divided between two subgroups: 1) citrus, melons, and berries, and 2) other fruit. The rationale for this division is to encourage consumption of citrus, melons, and berries, all of which tend to be rich in vitamin C. Although the most recent version of the Food Guide Pyramid does not suggest

a quantitative target for these two subgroups, evaluations of American diets and the U.S. food supply imply that 50 percent of consumption should come from each subgroup (Kantor, 1998; Tippett and Cleveland, 1999; Young and Kantor, 1999; Putnam *et al*., 2000).

Comparing Production, Consumption, and Food Guide Pyramid Recommendations

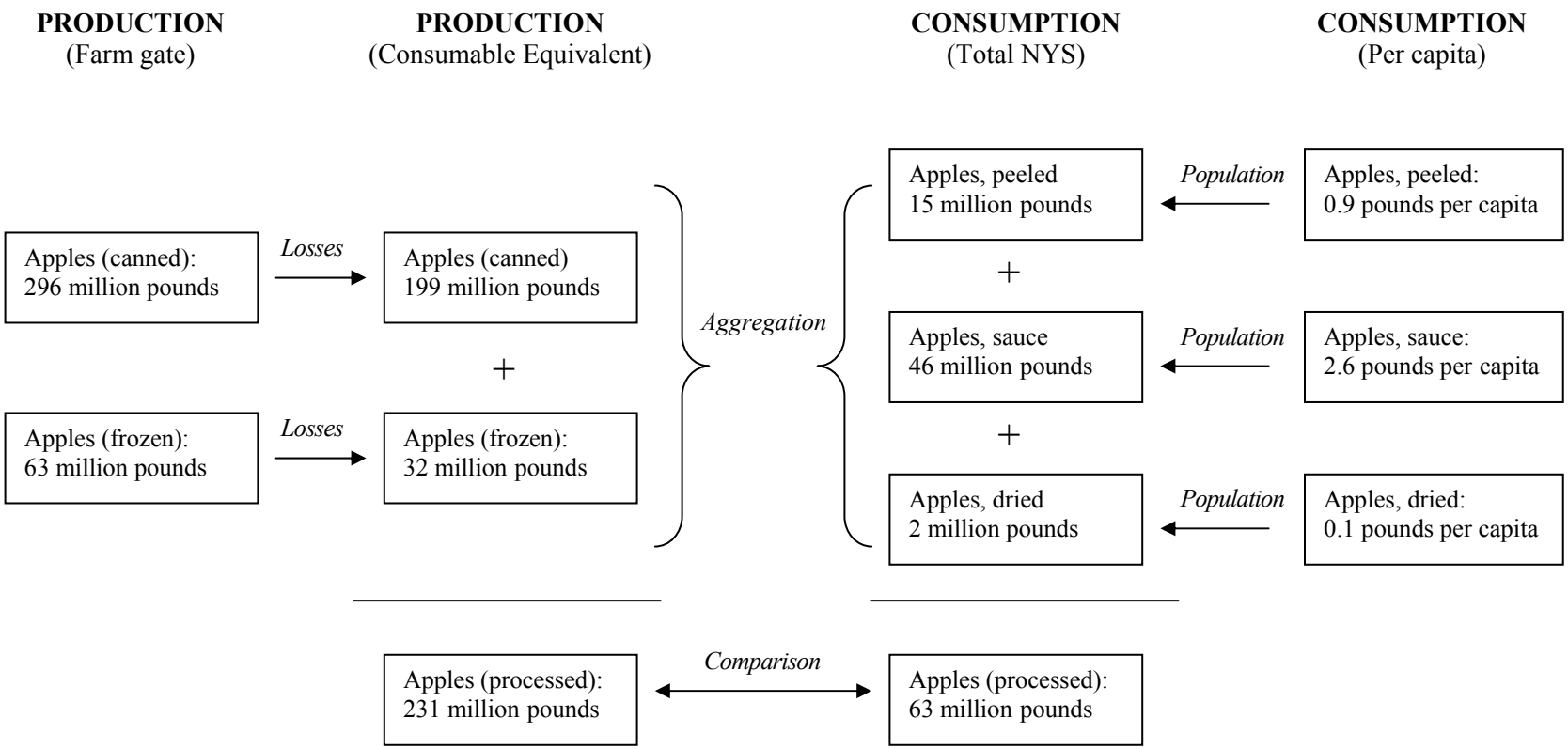
The steps taken to compare New York State fruit production data with fruit consumption data for the Northeast are illustrated in Figure 4. Production data were transformed by converting to a common unit, accounting for losses that occur between the farm gate and the consumer, and data were pooled when necessary to maintain parity with commodities on the consumption side (e.g., fresh cherry consumption includes both sweet and tart cherries). Per capita consumption data are transformed by converting to a common unit, extrapolating to estimate total state consumption, and data were pooled when necessary to maintain parity with production data.

The common unit to which agricultural production and food consumption data have been converted is pounds. Fruit production data have been converted from either tons or hundredweight, while fruit consumption data have been converted from grams per kilogram bodyweight.

Loss that occurs between the farm gate and the consumer was quantified using estimates from the USDA's Economic Research Service (ERS). ERS has produced estimates of food loss at five stages in the food distribution system (Kantor, 1998). They define these stages as "loss from primary to consumer weight"[5], "non-edible share", "cooking loss", "retail loss", and "foodservice and consumer loss". In this study, production data have been converted from a harvested weight (measured at the farm gate) to a consumable equivalent weight using the ERS percentage estimates for loss (see Appendix 4). Cooking loss (e.g., loss due to boiling, frying, steaming, etc.) was not included in this conversion.

[5] ERS defines "loss from primary to consumer weight" as loss that occurs between the farm gate and the retailer (e.g. evaporative losses, damage during transport, weight changes from food processing, etc.).

Figure 4: Flow diagram of steps in comparing production and consumption



ERS produces loss estimates for every food product that is tracked in their Food Supply data. However, this study includes fruits that are not tracked by ERS. Losses for fruits not tracked by ERS were estimated as follows. "Loss from primary to consumer weight", "retail loss" and "consumer and food service loss" were estimated using the average values of these losses for fresh fruit commodities. Estimates of the inedible share of non-ERS fruits were available in Matthews and Garrison (1975). Production and consumption data were grouped by crop and market channel (fresh, juice, other processed) to allow for comparison between the data sets. This regrouping was necessary because the crop categories used by NYASS and the Census of Agriculture do not always match exactly with those used in the FCID. For example, apples (other processed) compares production data for canned and frozen apples with consumption data for apple, sauce; apple, dried; and apple, w/o peel. This matching procedure is outlined for all crops in Appendix 8.

In order to compare fruit production data and per capita consumption data with the dietary guidelines, data were converted from a weight basis to a "servings" basis. The average weight of a single serving of a given fruit was determined using the USDA Nutrient Database for Standard Reference (NDB). By dividing the weight of the fruit consumed (or produced) by the average weight of one serving, an estimate of the number of servings consumed (produced) was obtained. Both are expressed in servings per capita, are compared with the average number of fruit servings per person recommended in the Food Guide Pyramid. These conversions are shown in Appendices 2 and 5.

As a final step, FCID intake data were converted into farm gate equivalent consumption using ERS estimates of losses, inedible portions, and farm weight to processed weight conversion factors (Appendix 7). This was done to account for major differences in the amount of farm production required to provide equal quantities of different fruit commodities (e.g. fresh apples vs. dried apples vs. apple juice). Farm gate equivalent consumption was compared with raw production data on a crop-by-crop basis.

RESULTS

The findings of this study are reported in five subsections. "Fruit Consumption in New York State" presents the estimates of total fruit consumption for New York State and addresses the differences between national and regional consumption data. "New York State Fruit Production" presents data on the kinds and amounts of fruits that are grown in New York and the amount of land used to raise them. "Comparing Fruit Production and Fruit Consumption in New York State" provides a detailed comparison of these two data sets and addresses the issue of food loss. "Comparing New York State Consumption and Production to the Dietary Guidelines" assesses the degree to which the estimated fruit consumption of New Yorkers meets, or fails to meet, the Pyramid guidelines and the degree to which production mirrors these recommendations. "Synthesizing the Results" integrates the findings' fruit consumption, agricultural production, and nutritional recommendations and prompts a discussion of the possible implications this research has for New York agriculture.

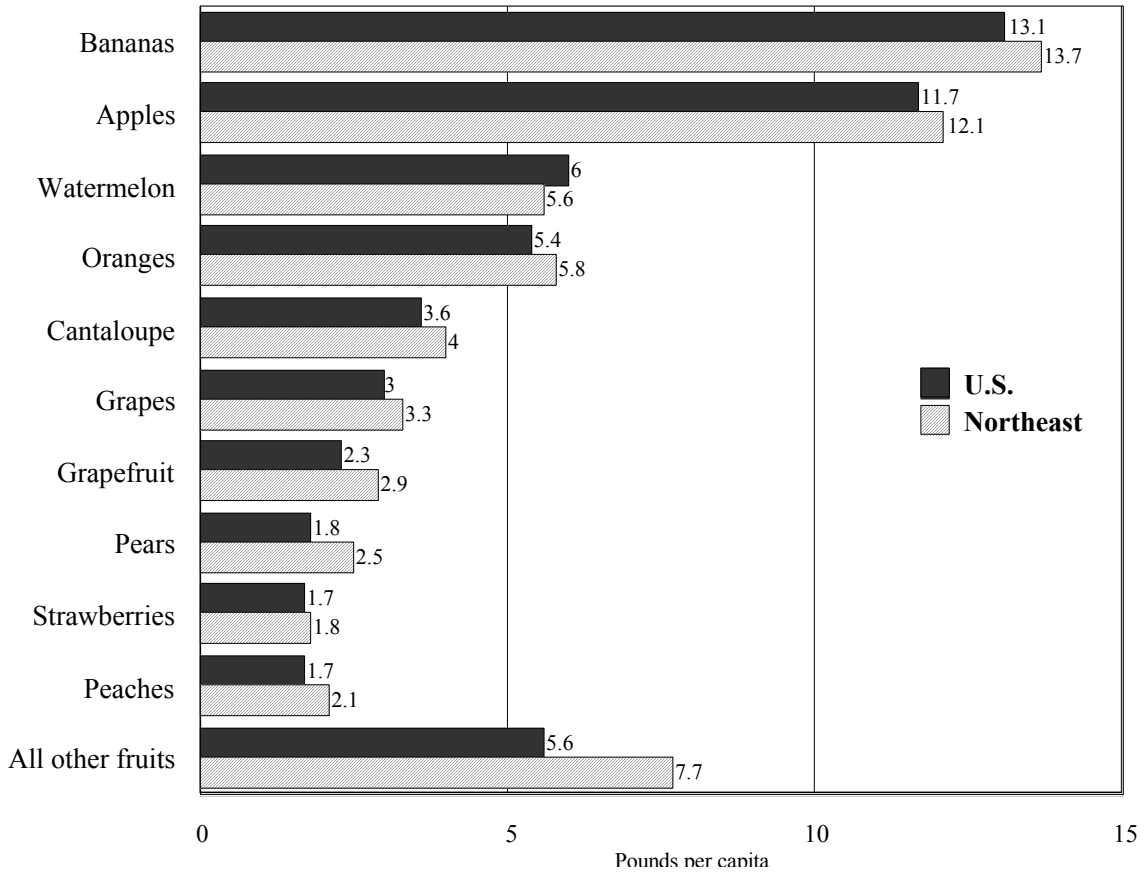
Fruit Consumption in New York State

As described in the methods section, Northeast regional food consumption data are believed to reflect the eating patterns of New York State residents better than national consumption data. In order to understand how the use of regional rather than national data influences the estimate of fruit consumption, US data were compared with that of the Northeast (Figures 5-7). Consumption of fresh fruit in the US and Northeast are comparable, though for most fruits, intake is slightly higher in the Northeast relative to the national average (Figure 5). In contrast, consumption of fruit juice appears markedly higher in the Northeast, particularly for the five most popular juices: orange, apple, grape, grapefruit, and cranberry (Figure 6). However, intake of fruit in other processed forms (canned, frozen, dried, etc.) appears to be slightly lower in the Northeast than in the nation as a whole (Figure 7).

In the aggregate, these differences suggest that Northeasterners consume considerably more fruit than does the average American. From 1994-96, total annual per capita consumption of fresh fruit, juices, and other processed fruits averaged 180 pounds in the Northeast compared with 148 pounds in the US. The majority of this difference is accounted for by juice drinking, though the slightly higher consumption of fresh fruit also contributes.

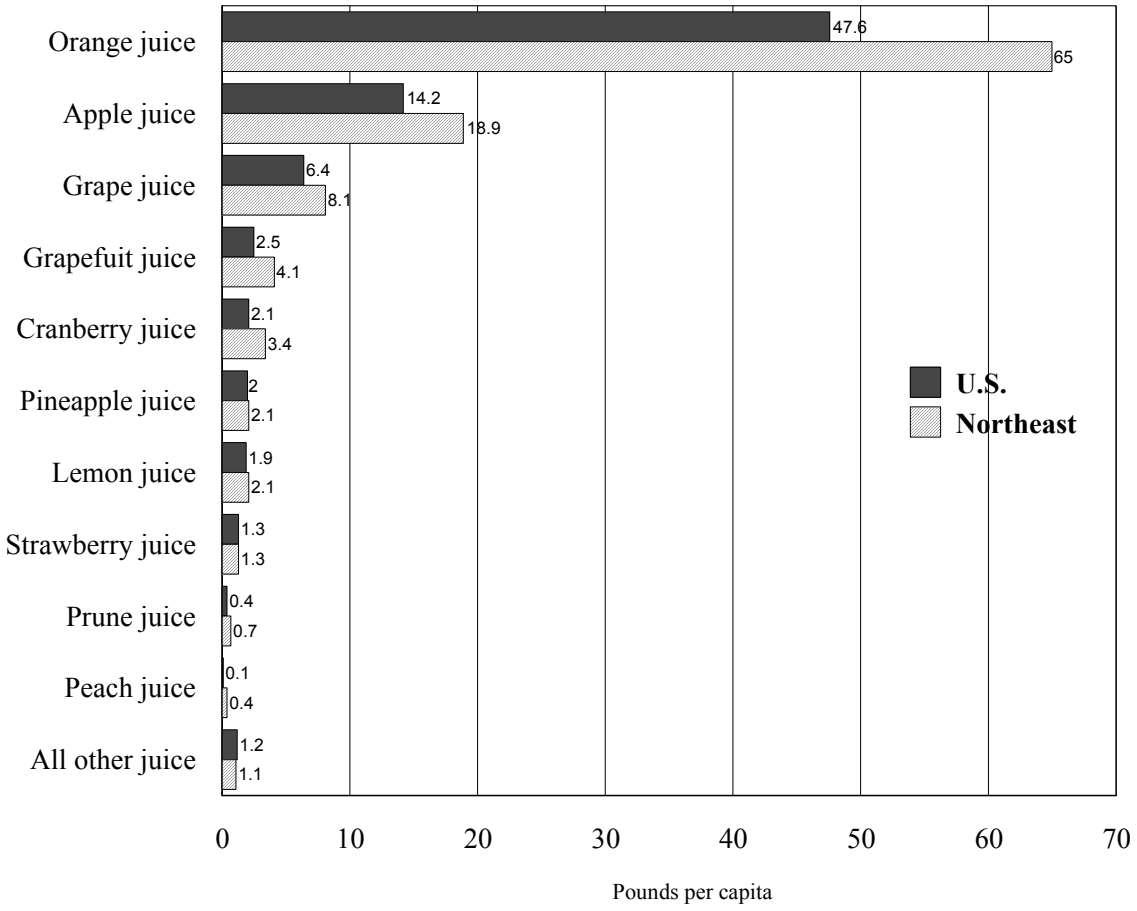
Based on these per capita estimates, total annual consumption of fruit commodities in New York State was approximately 3.2 billion pounds in calendar year 1999 (Table 2). The large majority of this fruit (1.9 billion pounds) was consumed in the form of juice, and most of the remainder was from fruit eaten fresh (1.1 billion pounds). Relatively little fruit, on a weight basis, was consumed in other processed forms.

Figure 5. Average annual per capita consumption of fresh fruit in the US and Northeast, 1994-96



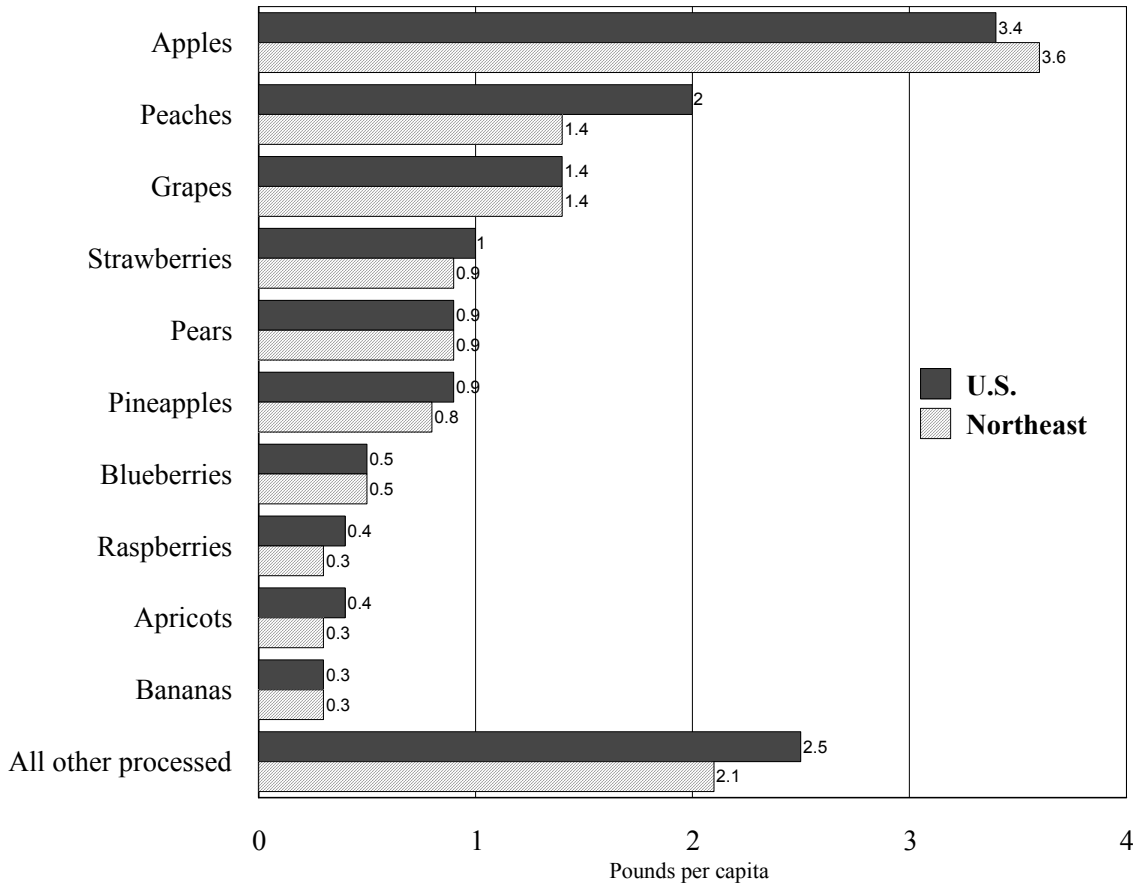
Source: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000).

Figure 6. Average annual per capita consumption of fruit juice in the US and Northeast, 1994-96



Source: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000).

Figure 7. Average annual per capita consumption of processed fruit in the US and Northeast, 1994-96[A]



[A] Includes canned, dried, frozen, and other processed forms. Excludes juice.

Source: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000).

Table 2. Estimated total annual consumption of fresh and processed fruits in New York State

FCID Commodity Name	Per Capita Consumption Northeast	Estimated Total Consumption for NYS[A]
	(lbs/person/yr)	*(lbs/yr)*
FRESH		
Bananas (fresh)	13.7	243,489,193
Apples (fresh)	12.1	213,827,243
Watermelon (fresh)	5.6	98,649,465
Oranges (fresh)	5.8	101,849,776
Cantaloupe (fresh)	4.0	71,616,347
Grapes (fresh)	3.3	59,252,428
Grapefruit (fresh)	2.9	51,975,799
Pears (fresh)	2.5	43,964,087
Strawberries (fresh)	1.8	32,458,443
Peaches (fresh)	2.1	36,419,309
All but top 10	7.7	135,938,569
TOTALS - Fresh	**61.5**	**1,089,440,659**
JUICE		
Orange (juice)	65.0	1,150,556,710
Apple (juice)	18.9	335,328,024
Grape (juice)	8.1	144,292,338
Grapefruit (juice)	4.1	72,164,611
Cranberry (juice)	3.4	60,293,759
Pineapple (juice)	2.1	37,750,658
Lemon (juice)	2.1	36,475,476
Strawberry (juice)	1.3	23,520,128
Prune (juice)	0.7	13,180,531
Peach (juice)	0.4	6,670,839
All other juice	1.1	20,277,895
TOTALS - Juice	**107.3**	**1,900,510,970**
OTHER PROCESSED[B]		
Apples	3.6	63,381,220
Peaches	1.4	24,206,215
Grapes	1.4	24,513,447
Strawberries	0.9	15,450,574
Pears	0.9	15,767,928
Pineapples	0.8	13,468,189
Blueberries	0.5	9,086,904
Raspberries	0.3	5,767,785
Apricots	0.3	5,359,823
Bananas	0.3	4,544,604
All other processed	1.0	18,586,459
TOTALS - Other Processed	**11.3**	**200,068,915**

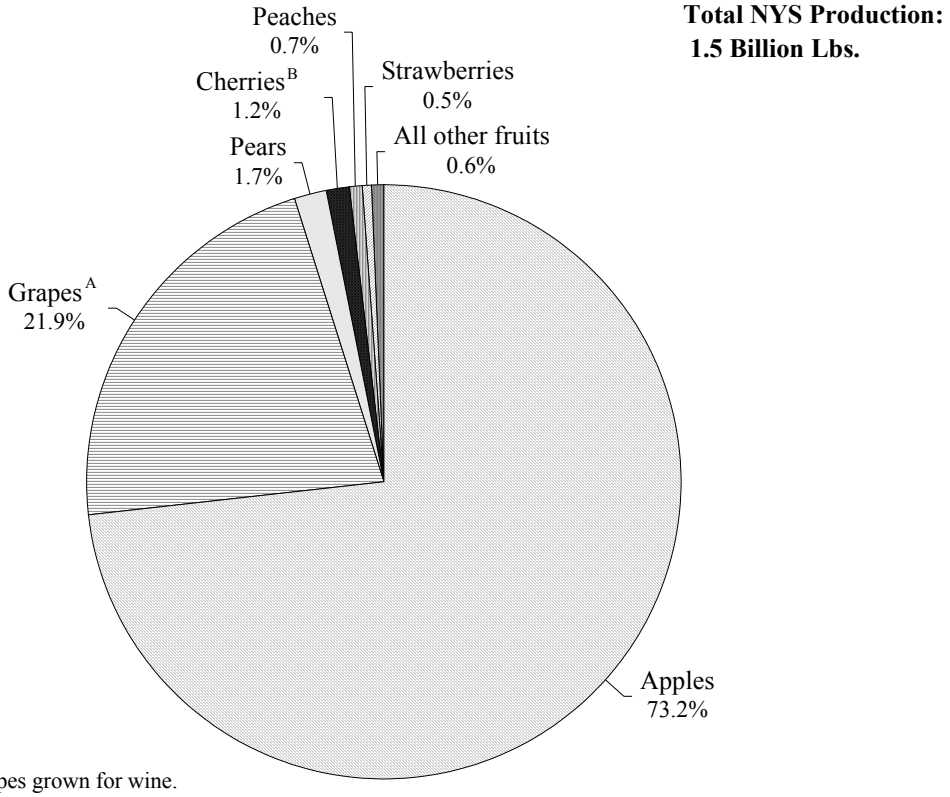
[A] Calculated based on Northeast per capita consumption and 1999 population estimates.
[B] Includes canned, dried, frozen, and other processed forms. Excludes juice.

Sources: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000) and Bureau of the Census (1999).

New York State Fruit Production

Production of fruit in New York State is clearly dominated by two crops: apples and grapes. These two crops combined comprised 95% of the total amount of fruit produced from 1994-98, while just 6% of the total came from the other 13 fruit crops grown in New York (Figure 8). Apples and grapes also occupy the largest share of cropland harvested for fruit production in New York State, accounting for 88% of the total harvested acreage from 1994-98 (Figure 9). Though the remaining fruit crops occupy a rather small share of the total land, it is large relative to their share of total production.

Figure 8. Average production of fruit in New York State (farm gate), 1994-98

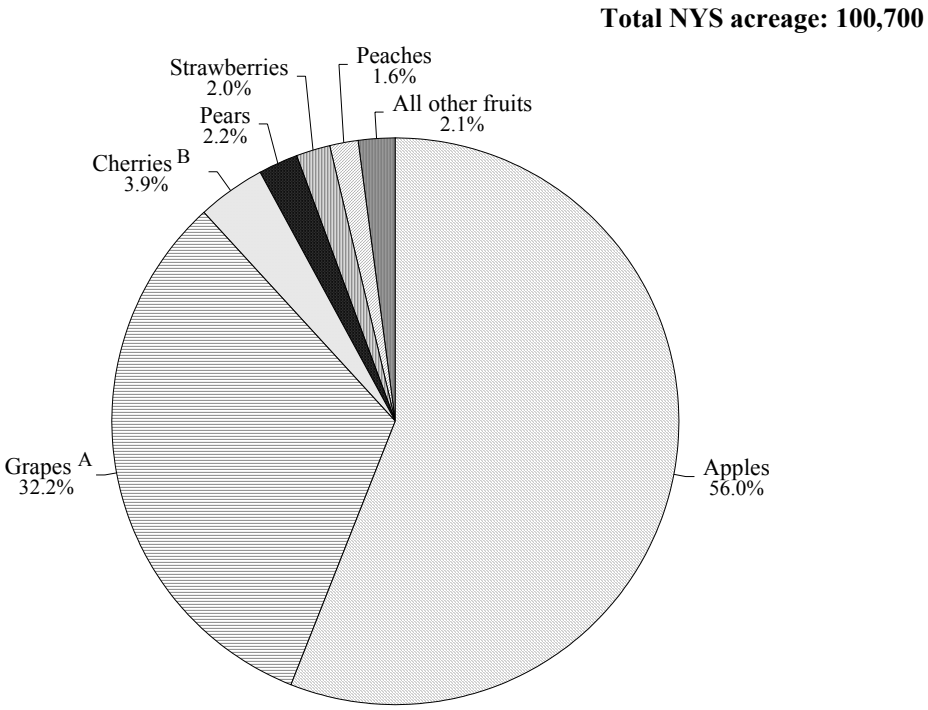


[A] Includes grapes grown for wine.

[B] Includes both sweet and tart types.

Sources: Derived from New York Agricultural Statistics Service (1999) and USDA National Agricultural Statistics Service (1999).

Figure 9. Average harvested area of fruit crops in New York State, 1994-98



[A] Includes grapes grown for wine.
[B] Includes both sweet and tart types.

Sources: Derived from New York Agricultural Statistics Service (1999) and USDA National Agricultural Statistics Service (1999).

On average, New York growers produced 1.5 billion pounds of fruit per year from 1994-98, harvesting approximately 100 thousand acres (Table 3). This fruit was sold through both fresh market and processed market channels, and the predominant market channel varied from crop to crop. For the major crops, utilization of apples was evenly split between fresh market and processed market (includes juice) uses, whereas utilization of grapes was dominated by processing (juice and wine) uses. For the minor crops, only cherries are used extensively for processing. Production for the remainder of the minor fruit crops is not differentiated by utilization, and it is assumed that these crops are sold primarily (if not exclusively) as fresh produce.

Table 3. Production, utilization[A], and harvested acreage of fruit in New York State: Average 1994-98

Fruit	Harvested Area 1994 to 1998	Production 1994 to 1998[B]
	(acres)	*(lbs)*
Apples	56,400	1,064,000,000
fresh		482,000,000
juice		197,400,000
canned		296,200,000
frozen		63,400,000
other processed[C]		25,000,000
Grapes	32,400	318,400,000
juice		203,200,000
wine		108,400,000
fresh		6,800,000
Cherries[D]	3,920	18,136,000
fresh		1,656,000
processed		16,480,000
Pears	2,260	25,400,000
Strawberries	1,980	7,500,000
Peaches	1,600	9,900,000
Blueberries	662	1,320,000
Red raspberries	450	1,010,000
Cantaloupe	376	3,008,000
Plums	337	1,655,812
Watermelon	107	1,284,000
Blackberries	64	112,328
Nectarines	49	452,955
Apricots	45	133,696
Honeydew melon	28	336,000
Currants	3	1,450
Other berries	2	2,520

[A] Utilization shown in italics. Not reported for all crops.
[B] Census of Agriculture only reports harvested acreage of melons. Production estimated using average yields from Zandstra and Price (1988).
[C] Includes vinegar, jelly, apple butter, mincemeat, fresh slices, and dried (New York Agricultural Statistics Service, 1999).
[D] Includes both sweet and tart types. Only tart types used for processing in NYS.

Sources: Derived from New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), and Zandstra and Price (1988).

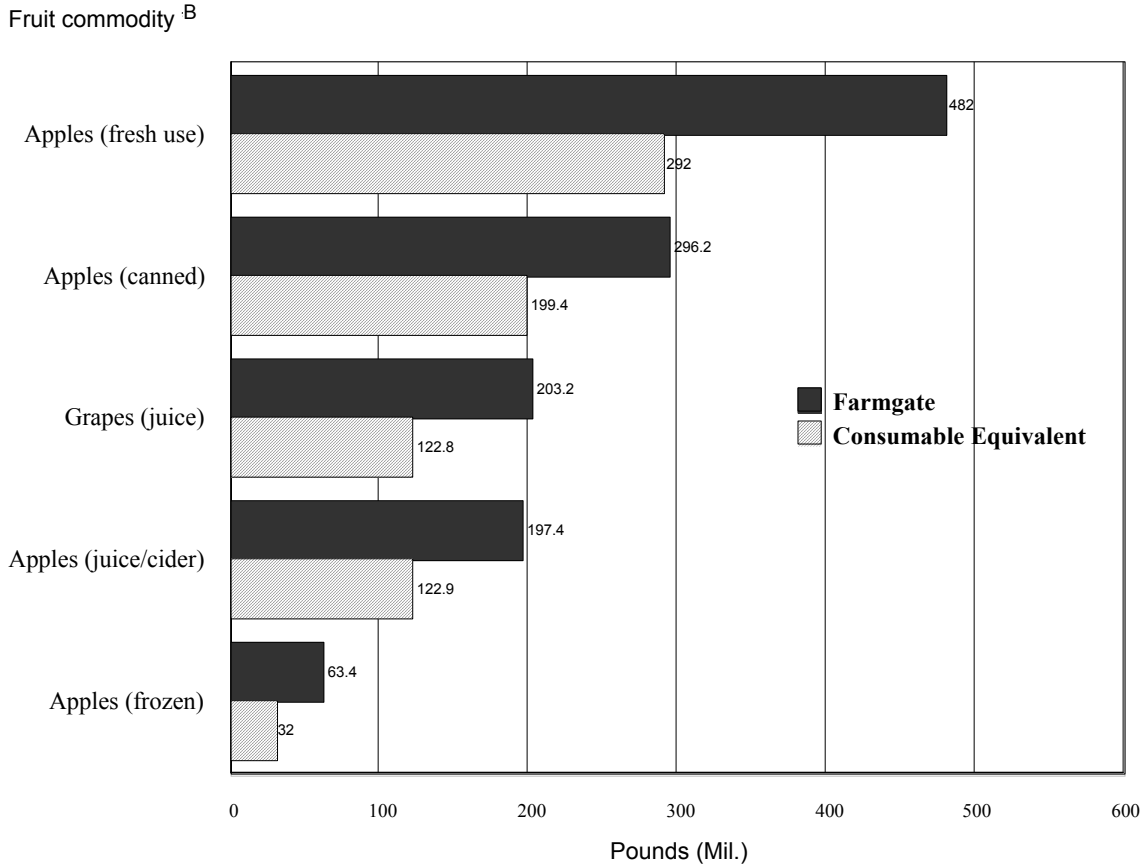
Comparing Fruit Production and Fruit Consumption

As discussed in the methods section, comparison of production data to consumption data requires accounting for losses that occur between harvest and consumption. This study takes the approach of converting the quantity of fruit harvested at the farm level to the equivalent amount of food actually consumed from that harvested production. Based on USDA Economic Research Service conversion factors for such losses, the "consumable

equivalent" of New York's fruit production is approximately 60% of the quantity measured at the farm gate (Figures 10 and 11).[6]

The magnitude of the change is relatively consistent for the major fruit commodities (Figure 10), though a few of the minor crops (notably melons) have much higher degrees of loss as a result of having large inedible portions — see Figure 11.

Figure 10. Comparison of fruit production measured at farm gate with amount available after adjusting for losses in food system [A]

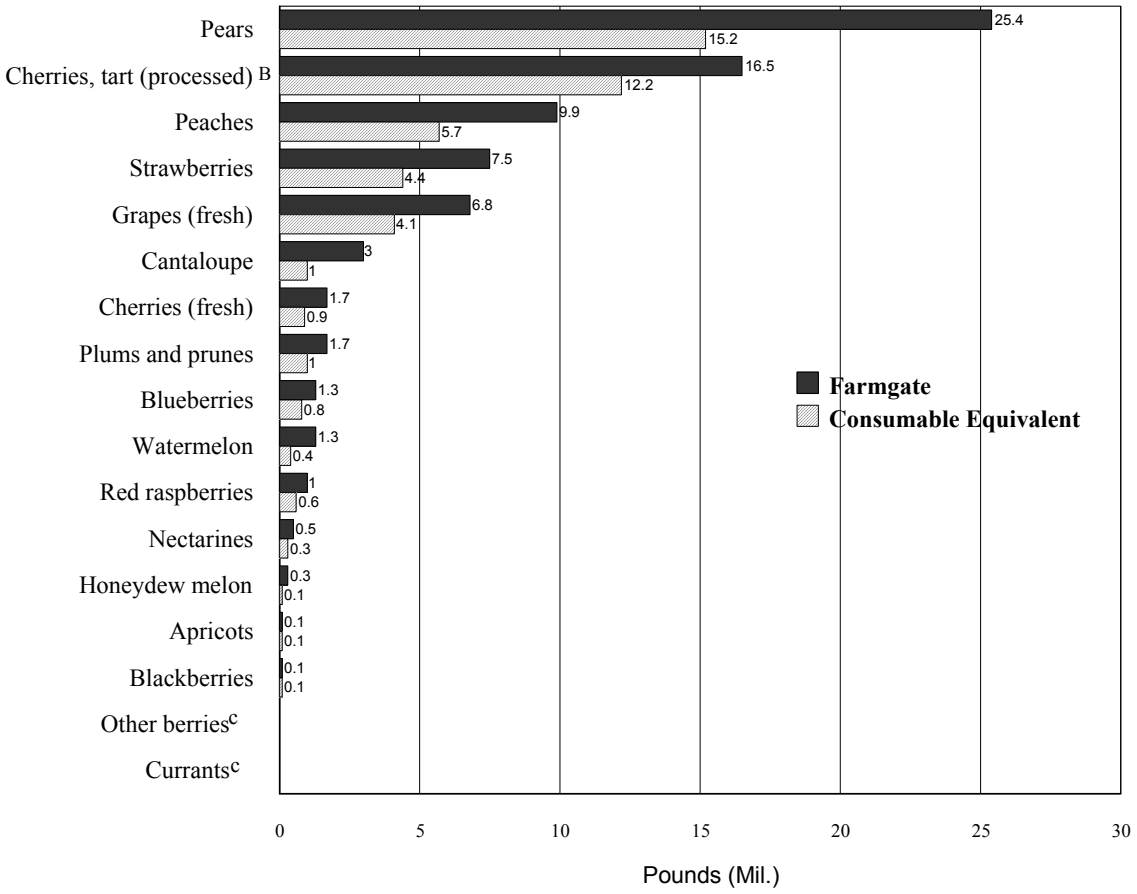


[A] See Appendix 4 for loss estimates and conversion factors used to calculate consumable equivalent production.
[B] Utilization indicated in parentheses.

Sources: Derived from New York Agricultural Statistics Service (1999), Kantor (1998), and Economic Research Service (1992).

[6] See Appendix 4 for calculations of loss for all commodities.

Figure 11. Comparison of fruit production measured at farm gate with amount available after adjusting for losses in food system[A]



[A] See Appendix 4 for loss estimates and conversion factors used to calculate consumable equivalent production.
[B] Utilization indicated in parentheses, if available. Otherwise, assumed fruit utilized for fresh market.
[C] Less than 0.1 million pounds.

Sources: Derived from New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), Zandstra and Price (1988), Kantor (1998), Economic Research Service (1992), and Matthews and Garrison (1975).

After adjusting for post-harvest losses and inedible portions, the consumable equivalent of New York's average annual fruit production is 816 million pounds (Table 4). This appears small relative to the 3.2 billion pounds of fruit consumed in the state annually. In addition, a crop-by-crop comparison shows that New York produces a few fruit commodities (fresh apples, processed apples, and processed cherries) in quantities that exceed the estimated in-state demand. As a result, New York produces enough fruit to provide 18 percent of the total fruit consumption plus 270 million pounds of "surplus" of the aforementioned commodities.

Table 4. Comparison of estimated New York State fruit consumption with New York State fruit production (in order of consumption)

Commodity[A]	Total Consumption[B]	Consumable Equivalent Production[C]	Amount Residual[D]	Ratio (Production to Consumption)[E]
	(lbs/yr)	*(lbs/yr)*	*(lbs/yr)*	*(%)*
Oranges (juice)	1,150,556,710	-	-	0.0%
Apples (juice)	335,328,024	122,922,954	-	36.7%
Bananas (fresh)	243,489,193	-	-	0.0%
Apples (fresh)	213,827,243	292,031,846	78,204,603	136.6%
Grapes (juice)	144,292,338	122,772,830	-	85.1%
Oranges (fresh)	101,849,776	-	-	0.0%
Watermelon (fresh)	98,649,465	412,226	-	0.4%
Grapefruit (juice)	72,164,611	-	-	0.0%
Cantaloupe (fresh)	71,616,347	968,189	-	1.4%
Apples (processed)	63,381,220	231,412,500	168,031,280	365.1%
Cranberries (juice)	60,293,759	-	-	0.0%
Grapes (fresh)	59,252,428	4,075,169	-	6.9%
All other fruit	575,319,429	41,571,349	9,473,277	5.6%
TOTALS	**3,190,020,543**	**816,167,064**	**255,709,161**	**17.6%**

[A] Aggregation of commodities from consumption and production data sets into single commodity groups shown in Appendix 8.
[B] Calculated based on Northeast per capita consumption and 1999 population estimates .
[C] See Appendix 4 for loss estimates and conversion factors used to calculate consumable equivalent production.
[D] Amount Residual = Consumable Equivalent Production - Total Consumption (if consumption > production then residual = 0)
[E] For individual commodities, ratio = consumable equivalent production / total consumption. For summary statistics, ratio = (consumable equivalent production - amount residual)/total consumption.

Sources: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000), Bureau of the Census (1999), New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), Zandstra and Price (1988), Kantor (1998), Economic Research Service (1992), and Matthews and Garrison (1975).

The ratios for individual crops indicate that this 18% is not evenly distributed. For some commodities (fresh apples, processed apples, grape juice) consumable equivalent production nearly meets or exceeds the estimated total consumption. For others, consumable equivalent production is just a fraction of the estimated consumption (fresh cantaloupes, grapes, and watermelon). Moreover, many of the most popular fruit commodities consumed in the Northeast simply are not produced at all in New York State.

This wide variation in production-consumption ratios is also observed among the less frequently consumed fruit commodities. The majority of these "minor" fruit crops simply are not produced in New York State (Table 5). Of those that are, most have production-to-consumption ratios in a middle range of 10 to 60 percent. However, a few crops fall outside this range. Blackberries and processed cherries are produced in quantities that nearly equal or exceed state consumption, whereas production of nectarines and honeydew melons is nearly negligible relative to consumption.

Table 5. Comparison of consumable equivalent (CE) production and total consumption for minor fruit crops in New York State: Average 1994-98 (in order of consumption)

Commodity[A]	Total Consumption[B]	Consumable Equivalent Production[C]	Amount Residual[D]	Ratio (Production to Consumption)[E]
	(lbs/yr)	*(lbs/yr)*	*(lbs/yr)*	*(%)*
Grapefruit (fresh)	51,975,799	-	-	0.0%
Plantains (fresh)	45,380,312	-	-	0.0%
Pears (fresh)	43,964,087	15,228,926	-	34.6%
Pineapple (juice)	37,750,658	-	-	0.0%
Lemon (juice)	36,475,476	-	-	0.0%
Peaches (fresh)	36,419,309	5,742,129	-	15.8%
Strawberries (fresh)	32,458,443	4,449,396	-	13.7%
Grapes (processed)	24,513,447	-	-	0.0%
Honeydew melon (fresh)	24,373,237	97,546	-	0.4%
Peaches (processed)	24,206,215	-	-	0.0%
Strawberry (juice)	23,520,128	-	-	0.0%
Pears (processed)	15,767,928	-	-	0.0%
Strawberries (processed)	15,450,574	-	-	0.0%
Pineapples (processed)	13,468,189	-	-	0.0%
Prune (juice)	13,180,531	-	-	0.0%
Nectarines (fresh)	13,010,182	262,720	-	2.0%
Blueberries (processed)	9,086,904	-	-	0.0%
Plums (fresh)	8,997,482	1,014,347	-	11.3%
Pineapples (fresh)	7,426,988	-	-	0.0%
Tangerines (fresh)	7,322,533	-	-	0.0%
Peach (juice)	6,670,839	-	-	0.0%
Pear (juice)	6,649,690	-	-	0.0%
Mangos (fresh)	6,326,617	-	-	0.0%
Lemons (fresh)	6,217,042	-	-	0.0%
Raspberries (processed)	5,767,785	-	-	0.0%
Apricots (processed)	5,359,823	-	-	0.0%
Blueberries (fresh)	5,055,864	825,291	-	16.3%
Lime (juice)	4,751,807	-	-	0.0%
Bananas (processed)	4,544,604	-	-	0.0%
Cranberries (processed)	3,773,581	-	-	0.0%
Cherries (fresh)[F]	3,753,117	940,621	-	25.1%
Kiwifruit (fresh)	3,436,569	-	-	0.0%
Plums (processed)	3,277,594	-	-	0.0%
Cherries (processed)[F]	2,772,096	12,245,373	9,473,277	441.7%
Blackberries (processed)	2,253,148	-	-	0.0%
Figs (processed)	2,208,964	-	-	0.0%
Cherry (juice)	2,160,089	-	-	0.0%
Raspberries (fresh)	1,723,086	618,585	-	35.9%
Casaba (fresh)	1,667,858	-	-	0.0%
Tangerine (juice)	1,596,387	-	-	0.0%
Watermelon (juice)	1,427,408	-	-	0.0%
Mango (juice)	1,146,168	-	-	0.0%
Apricot (juice)	1,052,254	-	-	0.0%

Table 5. Comparison of consumable equivalent (CE) production and total consumption for minor fruit crops in New York State: Average 1994-98 (in order of consumption) (continued)

Commodity[A]	Total Consumption[B]	Consumable Equivalent Production[C]	Amount Residual[D]	Ratio (Production to Consumption)[E]
	(lbs/yr)	*(lbs/yr)*	*(lbs/yr)*	*(%)*
Grapefruit (processed)	872,700	-	-	0.0%
Dates (processed)	737,642	-	-	0.0%
Plantains (processed)	616,771	-	-	0.0%
Tangerines (processed)	606,604	-	-	0.0%
Raspberry (juice)	550,058	-	-	0.0%
Papayas (processed)	523,213	-	-	0.0%
Blackberry (juice)	507,263	-	-	0.0%
Guava (processed)	476,921	-	-	0.0%
Passion fruit (juice)	427,812	-	-	0.0%
Papayas (fresh)	387,013	-	-	0.0%
Limes (fresh)	297,029	-	-	0.0%
Figs (fresh)	271,206	-	-	0.0%
Cantaloupe (processed)	182,792	-	-	0.0%
Boysenberries (processed)	139,674	-	-	0.0%
Apricots (fresh)	132,036	77,619	-	58.8%
Blackberries (fresh)	86,706	68,796	-	79.3%
Cranberries (fresh)	73,691	-	-	0.0%
Oranges (processed)	67,834	-	-	0.0%
Mangos (processed)	11,181	-	-	0.0%
Papaya (juice)	8,960	-	-	0.0%
Currants (processed)	864	-	-	0.0%
Lemons (processed)	590	-	-	0.0%
Huckleberries (processed)	42	-	-	0.0%
Gooseberries (processed)	14	-	-	0.0%
Other fruit[G]	NR	2,879	2,879	NA
SUBTOTAL - All other fruit	**575,319,429**	**41,571,349**	**9,473,277**	**5.6%**

[A] Aggregation of commodities from consumption and production data sets into single commodity groups shown in Appendix 8.
[B] Calculated based on Northeast per capita consumption and 1999 population estimates.
[C] See Appendix 4 for loss estimates and conversion factors used to calculate consumable equivalent production.
[D] Amount Residual = Consumable Equivalent Production - Total Consumption (if consumption > production then residual = 0)
[E] For individual commodities, ratio = consumable equivalent production / total consumption. For summary statistics, ratio = (consumable equivalent production - amount residual)/total consumption.
[F] Includes both sweet and tart types.
[G] Includes fruits grown in NYS for which no consumption was reported (currants and other berries)

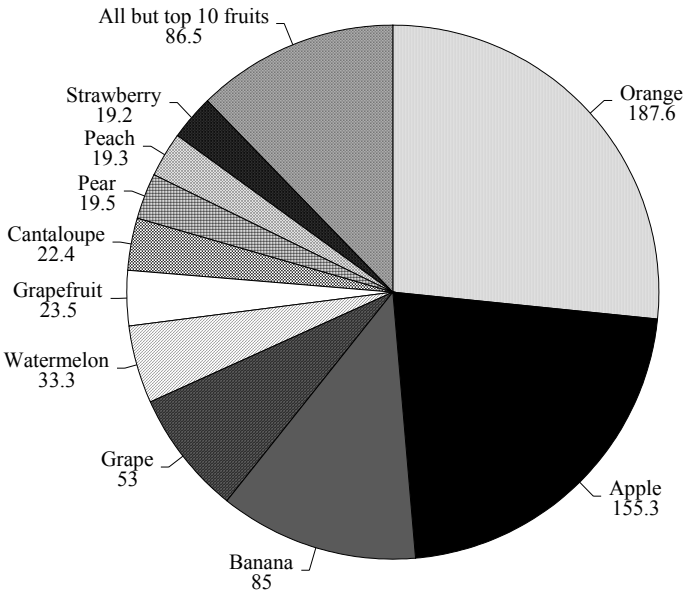
Sources: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000), Bureau of the Census (1999), New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999a), Zandstra and Price (1988), Kantor (1998), Economic Research Service (1992), and Matthews and Garrison (1975).

Comparing New York State Consumption and Production to the Dietary Guidelines

Comparing fruit consumption and production to the recommendations of the Food Guide Pyramid requires a shift in units from weight to food group servings. Based on this conversion, residents of the Northeast consume an average of 1.9 servings of fruit per day (Table 6). This level of intake falls well below the recommended consumption as the demographic calculations (outlined in the methods) indicate that New Yorkers should, on average, eat 3.1 servings of fruit per day. In order to close this gap, New Yorkers would need to increase consumption of fruits by at least 1.2 servings per day, approximately 60% greater than current levels of intake.

This gap is almost equally split between the two fruit subgroups. The number of servings consumed from "citrus, melons, and berries" is slightly lower than that of "other non-citrus fruits" (Table 6). Though the Pyramid recommendations suggest that half of fruit servings come from the vitamin C rich "citrus, melons, and berries", this slight deviation does not appear problematic. The main goal of the Pyramid recommendations is to increase consumption of fruits in general. However, consumption of juice, 37% of total

Figure 12. Variety of fruit consumption in diets of Northeasterners on a servings basis,[A] 1994-96.



[A] See Appendix 2 for conversion of intake data into servings.

Sources: Derived from USDA Agricultural Research Service (2001) and US Environmental Protection Agency and USDA Agricultural Research Service (2000).

servings, is high considering the emphasis the Food Pyramid places on consuming fruits in "whole" form.

In addition to meeting these subgroup recommendations, Food Pyramid recommendations stress that Americans need to consume a greater variety of fruit. Although no quantitative yardstick has been established to describe the diversity that is recommended, the composition of fruit consumption suggests that variety is lacking in the diets of Northeasterners (Figure 12).[7]. Just three fruits (oranges, apples, and bananas) provide 60% of all fruit servings consumed in the Northeast, and almost 90% of all servings are supplied by the ten most popular. Moreover, the "all other fruit" category, which provides only 12% of fruit servings, contains over 25 fruit crops (see Appendix 2). Thus, although many different fruit crops are included in the Northeastern diet as a whole, most of these are either consumed in very small amounts or by very few people. This suggests that many, if not most, Northeasterners should increase the variety of fruit they include in their diet.

Table 6. Average Northeast per capita consumption of fruit compared with average per capita Food Guide Pyramid recommendations for New York State

Fruit and form	Per Capita Consumption	Pyramid Guidelines	Share of Guidelines
	(servings/person/day)	*(servings/person/day)*	*(%)*
CITRUS, MELONS, & BERRIES			
Fresh	0.3	-	21%
Processed	0.0	-	2%
Juice	0.5	-	33%
Total	0.9	1.6	57%
OTHER NON-CITRUS			
Fresh	0.7	-	44%
Processed	0.2	-	10%
Juice	0.2	-	13%
Total	1.0	1.6	67%
ALL FRUITS	**1.9**	**3.1**	**62%**

[A] See Appendix 2 for conversion of consumption from pounds to servings.
[B] See Appendix 6 for calculation of average number of servings needed per day.

Sources: Derived from USDA Agricultural Research Service (2001), U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000), Bureau of the Census (1999), and Bowman *et al*. (1998).

[7] The Healthy Eating Index requires that a minimum of eight different foods be consumed per day to meet the guideline for variety in the diet. However, this guideline applies to *all* foods consumed in a day and is not an adequate yardstick for measuring variety in a single food group across the entire year.

Based on the consumable equivalent production, New York agriculture produces the equivalent of 0.6 fruit servings per person per day, or 20% of the recommended consumption (Table 7). Unlike consumption, production of fruit is almost entirely from the "other non-citrus" category. This comes as no surprise as the volume of production of melons and berries is minute relative to New York's two main fruit crops, apples and grapes. More importantly, it suggests that although a variety of fruit crops are grown in New York, most of these are available in very small amounts relative to the Food Pyramid emphasis on dietary diversity.

Table 7. Average New York State per capita fruit production compared with average per capita Food Guide Pyramid recommendations for New York State

Fruit and form	Per Capita Production[A]	Pyramid Guidelines[B]	Share of Guidelines
	(servings/person/day)	*(servings/person/day)*	*(%)*
MELONS AND BERRIES			
Fresh	Negligible	NA	Negligible
Processed	0.0	NA	0%
Juice	0.0	NA	0%
TOTAL	Negligible	1.6	Negligible
OTHER FRUIT			
Fresh	0.4	NA	24%
Processed	0.2	NA	10%
Juice	0.1	NA	6%
TOTAL	0.6	1.6	39%
ALL FRUITS	**0.6**	**3.1**	**20%**

[A] See Appendix 5 for conversion of consumption from pounds to servings.
[B] See Appendix 6 for calculation of average number of servings needed per day.
NA = Not applicable.

Sources: Derived from USDA Agricultural Research Service (2001), Bureau of the Census (1999), New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), Bowman *et al*. (1998), Kantor (1998), Economic Research Service (1992), Zandstra and Price (1988), and Matthews and Garrison (1975).

Synthesizing the Results

The intent of this research is to improve the understanding of the links between fruit consumption, fruit production, and nutrition within the context of New York agriculture. To this end, it is helpful to recast the comparison from the producer's perspective. This is accomplished in Tables 8 and 9 by reorganizing the comparison of production and consumption in order of the acres of NYS cropland occupied by individual fruit crops and by expressing consumption in terms of "farm gate" equivalents.

This comparison emphasizes that just two crops (apples and grapes) use the vast majority (87 percent) of harvested area and provide the vast majority (95 percent) of fruit production in New York State (Tables 8 and 9). The larger number of crops grown on medium and smaller acreages use a minor share of the harvested area and provide a modest share of the total production. However, crops in the medium acreage and small acreage categories are consumed in quantities far greater than the quantities in which they are produced, and may indicate opportunities for expansion. In contrast, the magnitude of intake from fruit crops that cannot be produced in New York (66 percent) suggests that climate and current food preferences limit the potential for linking fruit production and consumption in the state.

Table 8. Summary comparison of harvested area, farm gate production, and farm gate equivalent consumption of fruit in New York State

Crop type	Acreage	Percent of Total Fruit Acreage	Production	Percent of Total Farm Gate Production	Total Consumption	Percent of Total Consumption	Number of Crops
	Harvested (acres)	*(% of total)*	*Farm gate (lbs)*	*(% of total)*	*Farm gate equiv. (lbs/yr)*	*(% of total)*	*(#)*
Large Acreage	77,769	86.7%	1,382,400,000	95.2%	1,372,252,057	22.5%	2
Medium Acreage	9,760	10.9%	60,936,000	4.2%	311,576,667	5.1%	4
Small Acreage	2,123	2.4%	9,316,761	0.6%	529,604,466	8.7%	10
Unknown or no acreage[B]	na	na		na	105,978,432	1.7%	5
Cannot be grown in NYS[C]	-	-	-	-	3,767,323,505	61.9%	15
All fruit crops	**89,652**	**100.0%**	**1,452,652,761**	**100.0%**	**6,086,735,126**	**100.0%**	**36**

NA = data not available

[A] See Appendix 7 for loss estimates and conversion factors used to convert food intake to farm gate equivalent consumption.

[B] Includes crops that could be grown in New York State under conventional management but are either not tracked by the Census of Agriculture or have no reported production in the state.

[C] Includes crops that cannot be grown in New York State under conventional management.

Sources: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000), New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), Zandstra and Price (1988), Kantor (1998), Economic Research Service (1992), and Matthews and Garrison (1975).

Table 9. Comparing harvested area, farm gate production, and farm gate equivalent consumption of fruit in New York State

Crop type	Fruit	Acreage	Percent of Total Fruit Acreage	Production	Percent of Total Farm Gate Production	Total Consumption	Percent of Total Consumption
		Harvested (acres)	*(% of total)*	*Farm gate (lbs)*	*(% of total)*	*Farm gate equivalent (lbs/yr)*	*(% of total)*
Large Acreage	Apples	56,400	62.9%	1,064,000,000	73.2%	962,579,731	15.8%
	Grapes[A]	21,369	23.8%	318,400,000	21.9%	409,672,325	6.7%
	SUBTOTAL	**77,769**	**86.7%**	**1,382,400,000**	**95.2%**	**1,372,252,057**	**22.5%**
Medium Acreage	Cherries[B]	3,920	4.4%	18,136,000	1.2%	12,996,934	0.2%
	Pears	2,260	2.5%	25,400,000	1.7%	96,740,616	1.6%
	Strawberries	1,980	2.2%	7,500,000	0.5%	102,649,254	1.7%
	Peaches	1,600	1.8%	9,900,000	0.7%	99,189,863	1.6%
	SUBTOTAL	**9,760**	**10.9%**	**60,936,000**	**4.2%**	**311,576,667**	**5.1%**
Small Acreage	Blueberries	662	0.7%	1,320,000	0.1%	17,063,661	0.3%
	Red raspberries	450	0.5%	1,010,000	0.1%	9,069,399	0.1%
	Cantaloupe	376	0.4%	3,008,000	0.2%	153,231,202	2.5%
	Plums and prunes	337	0.4%	1,655,812	0.1%	44,898,944	0.7%
	Watermelon	107	0.1%	1,284,000	0.1%	215,314,579	3.5%
	Blackberries	64	0.1%	112,328	0.0%	3,187,985	0.1%
	Nectarines	49	0.1%	452,955	0.0%	20,106,625	0.3%
	Apricots	45	0.1%	133,696	0.0%	12,973,464	0.2%
	Honeydew melon	28	0.0%	336,000	0.0%	53,752,815	0.9%
	Currants	2	0.0%	1,450	0.0%	5,791	0.0%
	SUBTOTAL	**2,120**	**2.4%**	**9,314,241**	**0.6%**	**529,604,466**	**8.7%**
Miscellaneous	Other berries[C]	3	0.0%	2,520	0.0%	na	na
	SUBTOTAL	**3**	**0.0%**	**2,520**	**0.0%**	**na**	**na**
Unknown or no acreage	Boysenberry	-	-	-	-	148,442	0.0%
	Casaba	na	na	na	na	3,257,903	0.1%
	Cranberries	-	-	-	-	102,572,036	1.7%

Table 9. Comparing harvested area, farm gate production, and farm gate equivalent consumption of fruit in New York State (continued)

Crop type	Fruit	Acreage	Percent of Total Fruit Acreage	Production	Percent of Total Farm Gate Production	Total Consumption	Percent of Total Consumption
		Harvested (acres)	*(% of total)*	*Farm gate (lbs)*	*(% of total)*	*Farm gate equivalent (lbs/yr)*	*(% of total)*
Unknown or no acreage (cont.)	Gooseberry	na	na	na	na	10	0.0%
	Huckleberry	na	na	na	na	42	0.0%
	SUBTOTAL	**na**	**na**	**na**	**na**	**105,978,432**	**1.7%**
Cannot be grown in NYS	Banana	-	-	-	-	448,740,613	7.4%
	Date	-	-	-	-	976,719	0.0%
	Fig	-	-	-	-	7,925,376	0.1%
	Grapefruit	-	-	-	-	281,947,842	4.6%
	Guava	-	-	-	-	692,429	0.0%
	Kiwifruit	-	-	-	-	5,194,855	0.1%
	Lemons	-	-	-	-	139,216,384	2.3%
	Limes	-	-	-	-	13,163,024	0.2%
	Mangoes	-	-	-	-	12,901,313	0.2%
	Oranges	-	-	-	-	2,634,532,413	43.3%
	Papaya	-	-	-	-	2,643,917	0.0%
	Passion fruit, juice	-	-	-	-	706,488	0.0%
	Pineapples	-	-	-	-	116,933,808	1.9%
	Plantain	-	-	-	-	82,956,381	1.4%
	Tangerines	-	-	-	-	18,791,943	0.3%
	SUBTOTAL	**-**	**-**	**-**	**-**	**3,767,323,505**	**61.9%**
All fruit crops	**TOTALS**	**89,652**	**100.0%**	**1,452,652,761**	**100.0%**	**6,086,735,126**	**100.0%**

NA = Data not available.

[A] Excludes grapes used for wine. Acreage of grapes based on the percentage of total production utilized for juice or fresh market.
[B] Includes both sweet and tart types.
[C] Census of Agriculture "catch-all" classification for berry crops that do not fit into a specific crop class. Unclear how to compare to consumption data.

Sources: Derived from U.S. Environmental Protection Agency and USDA Agricultural Research Service (2000), New York Agricultural Statistics Service (1999), USDA National Agricultural Statistics Service (1999), Zandstra and Price (1988), Kantor (1998), Economic Research Service (1992), and Matthews and Garrison (1975).

DISCUSSION

This study was motivated by a growing national interest in the interrelationships among food consumption, agricultural production, and nutritional recommendations and by a concurrent interest in the potential of locally marketed foods to enrich New York's agriculture. As mentioned in the introduction, meaningful discussion of these issues requires an information-base that here-to-fore has not been compiled. Thus, this study was launched to provide benchmark data on how the state's fruit consumption, fruit production, and the Food Pyramid recommendations compare with one another today and to raise questions about the implications of these comparisons for New York agriculture.

The research findings are discussed in four sections: 1) issues related to the sources of data; 2) comparison of fruit consumption with fruit production in NYS; 3) consistency between Northeast diets and the Food Pyramid recommendations; and 4) the implications of the research for New York agriculture.

Data Issues

Food Consumption Data

The Food Commodity Intake Database (FCID) proved to be the optimal source of food consumption data for this study. It provides data for more than 40 different crops, and it is the only source of food consumption estimates for certain forms of many of the less frequently eaten fruits, such as fresh blackberries, blueberries, and raspberries. In addition, it allows for the calculation of average food consumption for individual regions. These qualities permit a detailed comparison of estimated New York State fruit consumption with the state's agricultural production and with national dietary guidelines. In spite of these advantages, however, the FCID has several limitations that constrain the interpretation of the analysis and the utility of this database for future work.

First of all, because the FCID consumption estimates are based on survey data, both the respondents' biases and the aptitude of the interviewer affect the accuracy of the data. Jonnalagadda and others (2000) claim that most studies of the accuracy of food intake surveys suggest that respondents underestimate their energy intake by 20 percent. Fruits, however, are generally considered healthy foods, and the consumption of fruit may not be underreported to the same degree as calories. Indeed, Kantor's (1998) comparison of loss-adjusted food supply data with the Continuing Survey of Food Intake by Individuals (CSFII) confirms this suspicion. Fruit consumption as measured by the 1994-96 CSFII is actually slightly higher than that estimated from the loss-adjusted food supply data (1.5 versus 1.3 servings per day, respectively) from the same time period. Since both data sets reach similar estimates of consumption, the survey data appear to provide relatively accurate estimates of fruit intake.

The second, and perhaps more serious, limitation of the FCID may be that it is a cross-sectional rather than a time-series data set. The consumption estimates reported in this database are based on survey data collected between 1994 and 1996, and they become less reflective of current food preferences with the passage of time. Unless national surveys of food consumption continue to be collected, and unless the EPA continues to convert survey data into FCID commodities, there will be no way of tracking future changes in food consumption using this data source. Because such surveys exact substantial financial and human resources, it is unclear whether they will continue to be conducted regularly.

Crop Production Data

A combination of the two major data sources on agricultural production provided information of all fruit crops grown in New York State. However, the quality of this coverage is not equal for all crops. Time-series data are consistently available through the state Agricultural Statistics Service for those crops that form the bulk of New York's fruit sector (e.g. apples, grapes, cherries, peaches, and pears). However, small acreage crops that are considered of lesser importance (such as apricots, cantaloupes, and plums) are not included in the NYASS statistical bulletin.

These small acreage crops may represent important niches or emerging market opportunities for NYS growers. Thus, the Census of Agriculture is an important complement to the NYASS annual data. It reports production estimates for a much larger number of crops, including those grown on a very limited scale (less than 50 acres in the state). Unfortunately, the Census tends to underreport production and is collected only once every five years. Thus, it is difficult to track trends using this data set, and growth in minor crops might go unnoticed until enough data is available to plot a trend line. If comprehensive production data is deemed to be valuable to the future of the state's agriculture, then more resources will need to be allocated to this important service.

Comparing Consumption and Production

Though the comparison of production with consumption probably provides the most intriguing data in this study, there is value in first considering the data individually. The per capita consumption data highlight some similarities and some differences between fruit intake in the US and fruit intake in the Northeast. The production data display the relative contribution of individual crops to the total New York fruit production sector.

Based on the comparison of national and regional data, per capita fruit consumption in the Northeast and the US is similar in terms of preferences for one fruit versus another, such as bananas over apples or orange juice over apple juice. However, consumption in absolute terms appears to be quite different. Consumption of most fresh fruits is

slightly higher in the Northeast than in the US as a whole, and consumption of juices is much higher. In contrast, consumption of most processed fruits is slightly lower. The relevance of this finding to New York agriculture is that Northeasterners are generally more eager to eat fruit than the nation as a whole, and they have a slight preference for fresh fruit. These findings may suggest a slight advantage for growers trying to market fresh fruit and fruit juice locally.

According to the combined NYASS and Census of Agriculture data, New York State specializes in production of only a few fruit crops, mirroring a larger national trend. Though a variety of fruit crops are grown in the state, 16 to be exact, just two crops predominate. Apple and grape crops account for 95% of production (see Figure 6) and occupy 88% of cropland devoted to fruit (see Table 8). The preeminence of these two crops begs the question, "What limits production of the other 14 crops?" Clearly, the risks posed by New York's cold winters and short harvest season present significant constraints for some, and supermarkets are often reluctant to work with local growers. However, as the following paragraphs show, consumption patterns may also restrict these crops to a mere "supporting role" in the state's fruit sector.

The comparison of fruit consumption with fruit production must be interpreted with care. It is intended to serve as a benchmark for assessing the potential for New York agriculture to supply the current demand for fruit in New York State. It is also intended to provide a point of departure for discussing where potential may exist for New York agriculture to expand its share of "local" markets. However, this comparison does not estimate the amount of New York grown produce that is consumed in the state, nor does it evaluate the relative ease or difficulty of expanding local market share for these crops. It does, however, raise engaging questions for New York's fruit production and marketing sectors.

According to the overall analysis, New York produces the *equivalent* of 18% of the total quantity of fruit consumed in the state. This implies that at least 82% of all fruit consumed in New York comes from outside the state.[8] This suggests that there is a large local market for fruit that is currently being supplied by non-local sources. The shear size of this market should provoke curiosity regarding the growth potential for New York's fruit production by targeting local demand in addition to competing in regional, national and international commodity market channels.

The comparison of individual crops suggests that fruit can be classified in four main categories. The first category contains crops for which production is nearly equal to or greater than consumption. It includes only a few commodities: fresh apples, processed apples, processed cherries, and grape juice. The second category contains crops for which in-state production is a sizable share (10% to 40%) of consumption. Most NYS fruit commodities fall in this category, including fresh apricots, blackberries, blueberries, cherries, peaches, pears, plums, raspberries, strawberries, and apple juice. The third category contains crops that are produced in minute quantities relative to consumption

[8] For a point of comparison, consider that New York produces the equivalent of 38% of all vegetables consumed by New York residents (Peters *et al*., 2002).

(<10%). It also contains several very popular fruits, including fresh grapes, melons, and nectarines. The fourth category contains those crops not grown in New York State.

Interpreting the degree to which the first three categories imply potential, or lack thereof, for increased marketing to local consumers often requires some added context. For example, although fresh apples are produced in quantities that exceed total consumption, the ubiquity of Washington State apples in Northeast supermarkets suggests that there may be potential to place more New York apples in the hands of New York consumers. In contrast, although strawberry production is just 14% of fresh strawberry consumption, potential for increasing consumption of local strawberries may be constrained by the crop's small harvest window (they are generally available only in the month of June and early July). While these ratios alone cannot predict whether or not a crop has potential for more local marketing, they clearly provide valuable quantitative evidence to inform such a discussion.

This uncertainty is not present in the fourth category: crops that cannot be grown in New York. Such crops constitute over 60% of all fruit consumption, suggesting that current food preferences clearly limit the degree to which the state could be "self-sufficient" in fruit production. If New York growers seek to market more of their goods locally, they may need to consider why consumer food preferences favor tropical and sub-tropical fruits over temperate ones.

An important shortcoming of these estimates is that they do not account for seasonal variation. Given New York's limited growing season, it is important to understand how consumption and production are distributed across the year. If intake is concentrated during certain seasons, then the ability of New York agriculture to supply such demand will be dependent on how well the consumption window corresponds with the harvest (availability) window. For example, consumption of watermelon, a quintessential summertime food, is likely to peak in the summer. However, the ability of New York growers to capitalize on this seasonal preference may depend on whether the apex of watermelon intake occurs around July fourth (over a month before the New York melon harvest), or around Labor Day (when harvest is in full swing). The presence or absence of these seasonal eating patterns can clearly influence the potential for increased marketing of local fruit, and enumeration of these patterns is an important data gap.

Impact of Nutrition

This analysis suggests that the diets of New Yorkers fail to meet the recommendations of the Food Guide Pyramid in three major ways. First, total consumption of fruit is only 1.9 servings per day, 38% below the average recommended number of servings. Second, fruit juices contribute more than one-third of total fruit consumption, whereas the Pyramid recommendations emphasize that whole fruit should be chosen most frequently. Third, nearly three-quarters of all fruit servings come from just 5 crops suggesting the need for greater variety of fruit in the diet.

These findings are consistent with previous analyses. Analysis of US food supply data suggests that Americans do not consume an adequate variety of fruit and that consumption of fruit in general is far below Food Pyramid recommendations (Kantor, 1998; Kantor, 1999; Putnam *et al*., 2000). Indeed, Putnam *et al.* (2000) show that though the quantity of fruit available in the US has continuously increased since 1970, the food supply provided less than half the required servings of fruit (1.4 versus 3.0) in 1999. Similarly, Kantor (1998) found that almost 50% of fruit servings available in the food supply come from just 5 foods (orange juice, apple juice, fresh apples, bananas, and watermelon). This congruence between the current study and national studies confirms that these deficiencies are real and worthy of concern.

It is important to recognize that comparing average consumption with average requirements hides the variability that exists in the greater population. There are undoubtedly both individuals who currently eat diets that closely conform to the Pyramid recommendations and those who consume fruit in quantities much lower than the current average. Indeed, analyses of CSFII data from the mid-1990s show that 17 percent of Americans meet the dietary recommendation for fruit (Bowman *et al*., 1998), yet only 50% of men and 55% of women eat *any* fruit or fruit juice in a given day (Wilkinson Enns *et al*., 1997). This wide distribution is relevant to the current discussion because it suggests that per capita consumption of fruit may need to be higher than the recommendation to ensure that Americans at the lower end of the consumption curve are meeting the recommended intake. Thus, the current comparison may understate the change needed in the food supply and the corresponding change in fruit production.

The need for increased fruit consumption is substantial. The question is whether or not a change in consumption can be realized and, if so, over what time horizon? US food supply data suggest that demand for fruit is growing gradually, increasing 28% since the early 1970s. Some of this change has been positive, such as the increase in consumption of cantaloupe and berries, 84% and 103%, respectively (Putnam *et al*., 2000). However, the increase in orange and apple juice consumption (14 and 272%, respectively) is a mixed blessing because these forms of fruit are high in calories and do not contribute fiber. The existence of such dichotomous trends (one of improved diet quality, the other of diminished quality) indicates that the extent and pace at which New Yorkers will adopt better eating habits remain unclear.

In addition to these two broad questions, this analysis of nutrition raises a host of more focused questions related to diets and agriculture. For example, which fruits would New Yorker's prefer to eat if they wished to increase the diversity of fruit in their diets? Can nutritional value be a successful marketing strategy for increasing consumption of less frequently consumed fruit crops (blueberries, for example)? What factors prevent people from eating more variety? Why is juice consumption so high relative to fresh fruit consumption? All of these questions imply that greater knowledge of the consumer will be necessary to increase the number of people that meet the dietary goals for fruit. The size of the deficit between current consumption and USDA Food Pyramid recommendations suggests that considering questions like these could be valuable to fruit growers.

Implications for New York's Agriculture

Identifying specific opportunities for New York growers to engage in local marketing lies beyond the scope of this study. However, this baseline analysis highlights several patterns that can inform the dialogue on the future of fruit production in the state. In addition, these patterns prompt some insightful questions that may help guide New York's fruit sector toward developing stronger links with the region's consumers.

The first pattern worth noting is that the majority of fruit consumption in New York State comes from crops that cannot be grown in this climate. Orange juice comprises the largest share of consumption of any single commodity, and bananas, citrus, pineapple, and other tropical fruits combine to account for more than 60% of total consumption. Thus, food preferences appear to exert a limit on the degree to which New York growers can target in-state markets, even before factors such as seasonality and price are considered. Fortunately, the nutritional comparison indicates that New Yorkers, and all other Americans, need to eat more fruit. This raises the question, could New York's fruit growers, processors, and retailers successfully encourage people to consider enjoying more locally-grown products rather than those produced in the tropics as they strive to increase their total fruit intake?

A second important pattern is the degree of specialization in New York's fruit sector. Apples and grapes dominate fruit crop agriculture in the state by all measures - harvested production, planted acreage, and sales. Yet, there are fourteen other crops grown in the state according to federal statistics (see Table 8). In addition, state agricultural statistics report data on processing for three fruit crops - apples, grapes, and cherries - suggesting that the remainder of New York fruit is not processed commercially. What constrains the expanded production and processing of these minor crops in New York State? If there were additional processing capacity, would production increase to meet resulting demand?

The third major pattern observed in this study is that diets of Northeasterners are well below the mark in terms of fruit consumption. Indeed, New Yorkers, on average, need to increase their fruit consumption by at least 1.2 servings *per day*. Moreover, this added intake should come in the form of whole fruit rather than juice. Food supply data collected by USDA Economic Research Service show that fruit consumption has been on the rise since the 1970s (Putnam *et al*., 2000), but the pace of change is slow. This increase in consumption will require increased fruit production somewhere. The question is can New York agriculture capitalize on the nutritional need for more fruit? Or, similarly, can New Yorkers be encouraged to look for more New York grown fruit as they seek to improve their diets?

This question, perhaps, gets at the heart of the matter. What encourages consumers to buy, or discourages them from buying, New York grown fruit? Is seasonal availability a constraint to consumption, or do people enjoy the changing variety across the harvest season? Do people consider the flavor and texture of tree- or vine-ripened fruit to be superior to fruit picked early for shipping? Are they aware of the unique apple and grape varieties that are grown in New York? Do they like to support local farms? Are

they unable to find local produce? Is it too expensive, or too inaccessible? None of these questions can be answered by this study, but they are all relevant in considering the potential of New York growers to reach local or in-state markets.

What is clear from this study is that production of fruit in New York State is low relative to consumption with the exception of just a few crops. The size of the market for fruit in New York clearly is large, but the potential to increase marketing of fruit to local consumers is uncertain. On one hand, seasonality may limit New York agriculture's ability to target local markets *if* consumers truly insist that all fruits be available year-round, in fresh form. Similarly, food preferences that favor citrus and tropical fruits may limit New York's capacity to supply the fruits consumers want. On the other hand, the need for greater fruit consumption is clearly established, and may present an opportunity for growers and retailers to market from the standpoint of nutrition. Combining this nutritional message with education on the quality of local fruit might further encourage New Yorkers to seek out local products.

As intended, this study sets a baseline for assessing the links between in-state consumption and production along with the implications of nutritional guidelines. With in-state production equaling just 18 percent of in-state consumption, there is clearly room for improvement. A more complete understanding of the factors that encourage or discourage consumers from buying New York fruit, and the factors that limit the expansion of New York fruit production, is essential. Based on the size of the New York market, the need for more fruit in the diet, and the fact that fruit consumption is already increasing, the potential for strengthening producer-to-consumer linkages seems promising. Local food economies is a strategy worthy of further consideration; it is hoped that this benchmark study will help to both enliven and inform this discussion.

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APPENDICES

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96.

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Apple, dried	dry weight; excluding peel, core, stem	P	0.0695	0.0851	122.4%
Apple, fruit with peel	weight of apple; including peel, excluding core and stem	F	11.6540	12.0718	103.6%
Apple, fruit with peel	weight of apple; including peel, excluding core and stem	P	0.0047	0.0009	18.1%
Apple, juice	weight of juice at single strength (or standard dilution)	F	0.6834	0.5901	86.3%
Apple, juice	weight of juice at single strength (or standard dilution)	P	13.4986	18.3302	135.8%
Apple, juice - babyfood	weight of juice at single strength (or standard dilution)	P	0.0331	0.0110	33.1%
Apple, peeled fruit	weight of apple; excluding peel, core and stem	F	0.0016	NR	0.0%
Apple, peeled fruit	weight of apple; excluding peel, core and stem	P	0.7725	0.8637	111.8%
Apple, peeled fruit-babyfood	weight of apple; excluding peel, core and stem	P	0.0002	0.0005	218.9%
Apple, sauce	weight of applesauce	F	2.4351	2.5673	105.4%
Apple, sauce	weight of applesauce	P	0.0903	0.0570	63.1%
Apple, sauce - babyfood	weight of applesauce	P	0.0102	0.0039	38.5%
Apricot	weight of pulp, with or without peel; excluding pit	F	0.0298	0.0075	25.0%
Apricot	weight of pulp, with or without peel; excluding pit	P	0.3148	0.2455	78.0%
Apricot- babyfood	weight of pulp, with or without peel; excluding pit	P	0.0002	0.0002	90.2%
Apricot, dried	dry weight of pulp, with or without peel; excluding pit	P	0.0371	0.0569	153.2%
Apricot, juice	weight of juice at single strength (or standard dilution)	P	0.0508	0.0592	116.7%
Apricot, juice- babyfood	weight of juice at single strength (or standard dilution)	P	0.0005	0.0002	33.5%
Banana	weight of pulp; excluding peel; juice	F	13.0734	13.7464	105.1%
Banana	weight of pulp; excluding peel; juice	P	0.3146	0.2385	75.8%
Banana- babyfood	weight of pulp; excluding peel; juice	P	0.0020	0.0020	96.5%
Banana, dried	dry weight of dried pulp; excluding peel (include weight of fruit from chips)	P	0.0086	0.0106	122.4%
Banana, dried- babyfood	dry weight of dried pulp; excluding peel (include weight of fruit from chips)	P	0.0012	0.0056	476.0%
Blackberry	weight of berry [B]	F	0.0145	0.0049	33.8%

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96 (continued).

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Blackberry	weight of berry [B]	P	0.1543	0.1272	82.4%
Blackberry, juice	weight of juice at single strength (or standard dilution) [B]	P	0.0092	0.0286	310.7%
Blackberry, juice - babyfood	weight of juice at single strength (or standard dilution) [B]	P	0.0005	NR	0.0%
Blueberry	weight of berry	F	0.2343	0.2854	121.8%
Blueberry	weight of berry	P	0.4952	0.5127	103.5%
Blueberry- babyfood	weight of berry	P	0.0002	0.0004	186.8%
Boysenberry	weight of berry	F	0.0012	NR	0.0%
Boysenberry	weight of berry	P	0.0108	0.0079	73.1%
Cantaloupe	weight of pulp; excluding seeds and outer rind [C]	F	3.6357	4.0432	111.2%
Cantaloupe	weight of pulp; excluding seeds and outer rind [C]	P	0.0050	0.0103	207.7%
Casaba	weight of pulp, excluding seeds and rind	F	0.0390	0.0942	241.5%
Cherry	weight of fruit; including skin; excluding pit and stem [D]	F	0.2219	0.2119	95.5%
Cherry	weight of fruit; including skin; excluding pit and stem [D]	P	0.3127	0.1564	50.0%
Cherry- babyfood	weight of fruit; including skin; excluding pit and stem [D]	P	0.0001	0.0001	101.5%
Cherry, juice	weight of juice at single strength (or standard dilution) [D]	P	0.1054	0.1219	115.7%
Cherry, juice- babyfood	weight of juice at single strength (or standard dilution) [D]	P	0.0000	NR	0.0%
Citrus citron	weight of pulp; excluding peel	P	0.0055	0.0036	66.1%
Citrus hybrids	weight of pulp; excluding seeds and peel [E]	F	0.0376	NR	0.0%
Cranberry	weight of berry	F	0.0318	0.0042	13.1%
Cranberry	weight of berry	P	0.1742	0.2023	116.2%
Cranberry, dried	dry weight of berry	P	0.0040	0.0107	267.2%
Cranberry, juice	weight of juice at single strength (or standard dilution)	P	2.0575	3.4039	165.4%
Currant	weight of berry	F	0.0008	NR	0.0%
Currant, dried	dry weight of berry	P	0.0003	0.0000	15.8%
Date	weight of fruit, excluding pit	P	0.0383	0.0416	108.8%

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96 (continued).

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Dewberry	weight of berry	P	0.0000	NR	0.0%
Fig	weight of fruit	F	0.0288	0.0153	53.2%
Fig	weight of fruit	P	0.0065	NR	0.0%
Fig, dried	dry weight of fruit	P	0.1140	0.1247	109.4%
Gooseberry	weight of berry	P	0.0000	0.0000	211.5%
Grape	weight of grape, with skin, and with or without seeds [F]	F	3.0489	3.3452	109.7%
Grape	weight of grape, with skin, and with or without seeds [F]	P	0.3184	0.2863	89.9%
Grape, juice	weight of juice at single strength (or standard dilution)	P	6.3575	8.1443	128.1%
Grape, juice- babyfood	weight of juice at single strength (or standard dilution)	P	0.0035	0.0018	52.0%
Grape, raisin	dry weight of raisin [G]	F	0.0090	0.0152	168.9%
Grape, raisin	dry weight of raisin [G]	P	1.0762	1.0825	100.6%
Grapefruit	weight of pulp; excluding seeds and rind	F	2.2874	2.9343	128.3%
Grapefruit	weight of pulp; excluding seeds and rind	P	0.0579	0.0493	85.1%
Grapefruit, juice	weight of juice at single strength (or standard dilution)	F	0.1418	0.0350	24.7%
Grapefruit, juice	weight of juice at single strength (or standard dilution)	P	2.4056	4.0391	167.9%
Guava	weight of pulp; excluding peel; juice	F	0.0158	NR	0.0%
Guava	weight of pulp; excluding peel; juice	P	0.0602	0.0269	44.7%
Honeydew melon	weight of pulp; excluding seeds and rind	F	0.9050	1.3760	152.0%
Honeydew melon	weight of pulp; excluding seeds and rind	P	0.0007	NR	0.0%
Huckleberry	Weight of berry	F	0.0005	NR	0.0%
Huckleberry	Weight of berry	P	0.0000	0.0000	194.1%
Kiwifruit	weight of pulp; excluding peel	F	0.2549	0.1940	76.1%
Lemon	weight of pulp; excluding seeds and peel	F	0.2154	0.3510	163.0%
Lemon	weight of pulp; excluding seeds and peel	P	0.0090	0.0000	0.4%
Lemon, juice	weight of juice at single strength (or standard dilution)	F	0.2261	0.2255	99.7%
Lemon, juice	weight of juice at single strength (or standard dilution)	P	1.6375	1.8338	112.0%
Lime	weight of pulp; excluding seeds and peel	F	0.0443	0.0168	37.9%

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96 (continued).

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Lime, juice	weight of juice at single strength (or standard dilution)	F	0.0018	0.0017	98.4%
Lime, juice	weight of juice at single strength (or standard dilution)	P	0.3362	0.2665	79.3%
Mango	weight of pulp; excluding peel	F	0.4218	0.3572	84.7%
Mango	weight of pulp; excluding peel	P	0.0005	0.0006	114.1%
Mango- babyfood	weight of pulp; excluding peel	P	0.0002	0.0001	29.7%
Mango, dried	weight of dried pulp	P	0.0034	NR	0.0%
Mango, juice	weight of juice at single strength (or standard dilution)	P	0.0706	0.0647	91.6%
Mango, juice - babyfood	weight of juice at single strength (or standard dilution)	P	0.0009	0.0000	5.4%
Mulberry	weight of fruit	F	0.0170	NR	0.0%
Nectarine	weight of pulp; including peel; excluding pit and stem	F	0.9412	0.7345	78.0%
Orange	weight of pulp; excluding seeds and peel	F	5.3927	5.7500	106.6%
Orange	weight of pulp; excluding seeds and peel	P	0.0326	0.0038	11.7%
Orange, juice	weight of juice at single strength (or standard dilution)	F	1.1519	1.0886	94.5%
Orange, juice	weight of juice at single strength (or standard dilution)	P	46.4032	63.8576	137.6%
Orange, juice- babyfood	weight of juice at single strength (or standard dilution)	P	0.0024	0.0096	401.8%
Papaya	weight of pulp; excluding peel and seeds	F	0.1494	0.0218	14.6%
Papaya	weight of pulp; excluding peel and seeds	P	0.0141	0.0177	126.0%
Papaya, dried	weight of dried pulp	P	0.0048	0.0118	244.3%
Papaya, juice	weight of juice at single strength (or standard dilution)	P	0.0258	0.0005	2.0%
Passionfruit	weight of pulp; excluding seeds and peel	F	0.0009	NR	0.0%
Passionfruit, juice	weight of juice at single strength (or standard dilution)	P	0.0285	0.0242	84.9%
Peach	weight of pulp, with or without peel; excluding pit	F	1.6648	2.0561	123.5%
Peach	weight of pulp, with or without peel; excluding pit	P	1.9700	1.3452	68.3%
Peach- babyfood	weight of pulp, with or without peel; excluding pit	P	0.0073	0.0095	130.0%
Peach, dried	weight of dried pulp, with or without peel; excluding pit	P	0.0064	0.0118	183.6%
Peach, juice	weight of juice at single strength (or standard dilution)	P	0.1346	0.3766	279.9%
Pear	weight of pulp, with or without peel; excluding core and stem [H]	F	1.8411	2.4820	134.8%

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96 (continued).

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Pear	weight of pulp, with or without peel; excluding core and stem [H]	P	0.8870	0.8705	98.1%
Pear- babyfood	weight of pulp, with or without peel; excluding core and stem	P	0.0126	0.0075	59.6%
Pear, dried	weight of dried pulp, with or without peel	P	0.0048	0.0122	256.3%
Pear, juice	weight of juice at single strength (or standard dilution)	F	0.0004	NR	0.0%
Pear, juice	weight of juice at single strength (or standard dilution)	P	0.3408	0.3751	110.1%
Pear, juice- babyfood	weight of juice at single strength (or standard dilution)	P	0.0085	0.0003	3.5%
Persimmon	weight of entire fruit, pulp and peel	F	0.0931	NR	0.0%
Pineapple	weight of pulp; excluding leaves and outer peel	F	0.3414	0.4193	122.8%
Pineapple	weight of pulp; excluding leaves and outer peel	P	0.8853	0.7484	84.5%
Pineapple- babyfood	weight of pulp; excluding leaves and outer peel	P	0.0004	0.0001	27.4%
Pineapple, dried	weight of dried pulp only	P	0.0067	0.0118	175.7%
Pineapple, juice	weight of juice at single strength (or standard dilution)	F	0.0047	NR	0.0%
Pineapple, juice	weight of juice at single strength (or standard dilution)	P	1.9976	2.1303	106.6%
Pineapple, juice- babyfood	weight of juice at single strength (or standard dilution)	P	0.0015	0.0009	62.5%
Plantain	weight of pulp; excluding skin	F	0.6907	2.5620	370.9%
Plantain	weight of pulp; excluding skin	P	0.0090	0.0348	388.3%
Plantain, dried	weight of dried pulp only	F	0.0002	NR	0.0%
Plum	weight of pulp with peel; excluding pit	F	0.4981	0.5080	102.0%
Plum	weight of pulp with peel; excluding pit	P	0.0093	0.0076	81.5%
Plum- babyfood	weight of pulp with peel; excluding pit	P	0.0011	0.0002	20.8%
Plum, prune, dried	weight of dried flesh, with or without peel; excluding pit	P	0.0898	0.1141	127.1%
Plum, prune, fresh	weight of plum, with peel; excluding pit	F	0.0002	NR	0.0%
Plum, prune, fresh	weight of plum, with peel; excluding pit	P	0.0908	0.0630	69.4%
Plum, prune, fresh-babyfood	weight of plum, with peel; excluding pit	P	0.0011	0.0001	9.5%
Plum, prune, juice	weight of juice at single strength (or standard dilution)	P	0.3764	0.7441	197.7%
Plum, prune, juice-babyfood	weight of juice at single strength (or standard dilution)	P	0.0001	NR	0.0%
Pomegranate	weight of pulp; excluding peel and seeds [I]	F	0.0187	NR	0.0%

Appendix 1. Estimated annual per capita consumption of fruit in the U.S. and Northeast [A], 1994-96 (continued).

FCID Commodity	Description	Food form	Consumption U.S.	Consumption Northeast	Ratio NE/US
			(lbs/person/yr)	*(lbs/person/yr)*	*(%)*
Raspberry	weight of berry	F	0.1093	0.0973	89.0%
Raspberry	weight of berry	P	0.3676	0.3256	88.6%
Raspberry- babyfood	weight of berry	P	0.0000	0.0000	143.4%
Raspberry, juice	weight of juice at single strength (or standard dilution)	P	0.0399	0.0311	77.8%
Starfruit	weight of fruit, including seeds and peel [J]	F	0.0020	NR	0.0%
Strawberry	weight of berry; excluding leaf cap	F	1.7430	1.8325	105.1%
Strawberry	weight of berry; excluding leaf cap	P	0.9781	0.8723	89.2%
Strawberry, juice	weight of juice at single strength (or standard dilution)	P	1.3207	1.3279	100.5%
Strawberry, juice - babyfood	weight of juice at single strength (or standard dilution)	P	0.0001	NR	0.0%
Tangerine	Weight of pulp; excluding seeds and peel [K]	F	0.2394	0.4134	172.7%
Tangerine	Weight of pulp; excluding seeds and peel [K]	P	0.0687	0.0342	49.9%
Tangerine, juice	weight of juice at single strength (or standard dilution) [K]	P	0.1257	0.0901	71.7%
Watermelon	weight of pulp and rind; excluding seeds [L]	F	5.9989	5.5694	92.8%
Watermelon	weight of pulp and rind; excluding seeds [L]	P	0.0003	NR	0.0%
Watermelon, juice	weight of juice at single strength (or standard dilution)	P	0.0289	0.0806	279.0%

F = fresh.
P = processed (includes canned, dried, frozen, and other processed types).
NR = no consumption reported in survey.
[A] Includes Connecticut, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[B] Includes Marionberry, Olallieberry, and Youngberry.
[C] Includes wintermelon.
[D] Includes Sweet cherry and Sour or tart cherry.
[E] Includes tangelo, Tangor, Chironja, and Calamondin.
[F] Includes Muscadine.
[G] Includes Zante currant.
[H] Include Oriental pear.
[I] Seeds are usually not consumed.
[J] Also called Carambola.
[K] Include mandarin.
[L] To include weight of pickled watermelon rind.

Source: Derived from US Environmental Protection Agency and USDA Agricultural Research Service, 2000.

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96.

FCID Commodity Name	Food form	Nutrient Database Number	Nutrient Database Serving Portion [A]	Serving weight	Consumption Northeast
				(grams)	*(servings/person/yr)*
CITRUS, MELONS & BERRIES					
Blackberry	F	09042	1/2 cup	72	0.03
Blueberry	F	09050	1/2 cup	73	1.79
Cantaloupe	F	09181	1/2 cup balls, 1/2 cup cubes, 1/2 cup diced	82	22.34
Casaba	F	09183	1/2 cup cubes	85	0.50
Cranberry	F	09078	1/2 cup chopped, 1/2 cup whole	51	0.04
Grapefruit	F	09111	1/2 small fruit (3 1/2 in diameter)	100	13.32
Honeydew melon	F	09184	1/2 cup balls, 1/2 cup cubes	87	7.20
Lemon	F	09150	1/2 cup of sections	106	1.50
Lime	F	09159	1 medium fruit	67	0.11
Orange	F	09200	1/2 cup sections	90	29.01
Raspberry	F	09302	1/2 cup	62	0.72
Strawberry	F	09316	1/2 cup halves, 1/2 cup sliced, 1/2 cup whole	77	10.80
Tangerine	F	09218	1/2 cup sections	98	1.92
Watermelon	F	09326	1/2 cup balls, 1/2 cup diced	77	33.05
SUBTOTAL - fresh					**122.34**
Blackberry	P	09042	1/2 cup	72	0.80
Blueberry	P	09050	1/2 cup	73	3.21
Blueberry- babyfood	P	09050	1/2 cup	73	0.00
Boysenberry	P	09057	1/2 cup, unthawed	66	0.05
Cantaloupe	P	09181	1/2 cup balls, 1/2 cup cubes, 1/2 cup diced	82	0.06
Citrus citron	P	NL [B]	1/4 cup	38	0.04
Cranberry	P	09078	1/2 cup chopped, 1/2 cup whole	51	1.79
Cranberry, dried	P	NL [B]	1/4 cup	38	0.13
Gooseberry	P	09107	1/2 cup	75	0.00

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96 (continued).

FCID Commodity Name	Food form	Nutrient Database Number	Nutrient Database Serving Portion [A]	Serving weight	Consumption Northeast
				(grams)	*(servings/person/yr)*
Grapefruit	P	09111	1/2 small fruit (3 1/2 in diameter)	100	0.22
Huckleberry	P	NL [C]	1/2 cup	68	0.00
Lemon	P	09150	1/2 cup of sections	106	0.00
Orange	P	09200	1/2 cup sections	90	0.02
Raspberry	P	09302	1/2 cup	62	2.40
Strawberry	P	09316	1/2 cup halves, 1/2 cup sliced, 1/2 cup whole	77	5.14
Tangerine	P	09218	1/2 cup sections	98	0.16
SUBTOTAL - Processed					**14.04**
Blackberry, juice	P	NL [D]	6 fluid oz	186	0.07
Cranberry, juice	P	NL [D]	6 fluid oz	186	8.29
Grapefruit, juice	P	09123	6 fluid oz	185	9.91
Grapefruit, juice	F	09123	6 fluid oz	185	0.09
Lemon, juice	P	09152	6 fluid oz	183	4.55
Lemon, juice	F	09152	6 fluid oz	183	0.56
Lime, juice	P	09160	6 fluid oz	185	0.65
Lime, juice	F	09160	6 fluid oz	185	0.00
Orange, juice	P	09206	6 fluid oz	186	155.87
Orange, juice	F	09206	6 fluid oz	186	2.66
Orange, juice- babyfood	P	09206	6 fluid oz	186	0.02
Raspberry- babyfood	P	09302	1/2 cup	62	0.00
Raspberry, juice	P	NL [D]	6 fluid oz	186	0.08
Strawberry, juice	P	NL [D]	6 fluid oz	186	3.23
Tangerine, juice	P	NL [D]	6 fluid oz	186	0.22
Watermelon, juice	P	NL [D]	6 fluid oz	186	0.20
SUBTOTAL - Juice					**186.40**

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96 (continued).

FCID Commodity Name	Food form	Nutrient Database Number	Nutrient Database Serving Portion [A]	Serving weight	Consumption Northeast
				(grams)	*(servings/person/yr)*
OTHER NON-CITRUS					
Apple, fruit with peel	F	09003	1/2 cup chopped or 1/2 cup slices (average)	59	93.29
Apricot	F	09021	1/2 cup	80	0.04
Banana	F	09040	1/2 cup slices	75	83.21
Cherry	F	09063, 09070	1/2 cup, without pits	75	1.28
Fig	F	09089	1 large fig	64	0.11
Grape	F	09132	1/2 cup, seedless	80	18.98
Kiwifruit	F	09148	1/2 cup	89	1.00
Mango	F	09176	1/2 cup slices	83	1.97
Nectarine	F	09191	1/2 cup slices	69	4.83
Papaya	F	09226	1/2 cup cubes	70	0.14
Peach	F	09236	1/2 cup slices	85	10.98
Pear	F	09252	1/2 cup slices	83	13.66
Pineapple	F	09266	1/2 cup diced	78	2.46
Plantain	F	09277	1/2 cup sliced	74	15.72
Plum	F	09279	1/2 cup slices	83	2.80
SUBTOTAL - Fresh					**250.46**
Apple, dried	P	09011	1/4 cup	22	1.80
Apple, fruit with peel	P	09003	1/2 cup chopped or 1/2 cup slices (average)	59	0.01
Apple, peeled fruit	P	09014	1/2 cup slices	94	4.19
Apple, peeled fruit- babyfood	P	09014	1/2 cup slices	94	0.00
Apple, sauce	P	09019	1/2 cup	122	0.21
Apple, sauce	F	09019	1/2 cup	122	9.55
Apple, sauce - babyfood	P	09019	1/2 cup	122	0.01
Apricot	P	09021	1/2 cup	80	1.39
Apricot- babyfood	P	09021	1/2 cup	80	0.00

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96 (continued).

FCID Commodity Name	Food form	Nutrient Database Number	Nutrient Database Serving Portion [A]	Serving weight *(grams)*	Consumption Northeast *(servings/person/yr)*
Apricot, dried	P	09032	1/4 cup	33	0.79
Banana	P	09040	1/2 cup slices	75	1.44
Banana- babyfood	P	09040	1/2 cup slices	75	0.01
Banana, dried	P	09041	1/4 cup	25	0.19
Banana, dried- babyfood	P	09041	1/4 cup	25	0.10
Cherry	P	09063, 09070	1/2 cup, without pits	75	0.95
Cherry- babyfood	P	09063, 09070	1/2 cup, without pits	75	0.00
Currant, dried	P	09085	1/4 cup	36	0.00
Date	P	09087	1/4 cup, pitted	45	0.42
Fig, dried	P	09094	1/4 cup	50	1.14
Grape	P	09132	1/2 cup, seedless	80	1.62
Grape, raisin	P	09298	1/4 cup packed, 1/4 cup unpacked	39	12.68
Grape, raisin	F	09298	1/4 cup packed, 1/4 cup unpacked	39	0.18
Guava	P	09139	1/2 cup	83	0.15
Mango	P	09176	1/2 cup slices	83	0.00
Mango- babyfood	P	09176	1/2 cup slices	83	0.00
Papaya	P	09226	1/2 cup cubes	70	0.11
Papaya, dried	P	NL [B]	1/4 cup	38	0.14
Peach	P	09236	1/2 cup slices	85	7.19
Peach- babyfood	P	09236	1/2 cup slices	85	0.05
Peach, dried	P	09246	1/4 cup halves	40	0.13
Pear	P	09252	1/2 cup slices	83	4.79
Pear- babyfood	P	09252	1/2 cup slices	83	0.04
Pear, dried	P	09259	1/4 cup halves	45	0.12
Pineapple	P	09266	1/2 cup diced	78	4.38
Pineapple- babyfood	P	09266	1/2 cup diced	78	0.00
Pineapple, dried	P	NL [B]	1/4 cup	38	0.14

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96 (continued).

FCID Commodity Name	Food form	Nutrient Database Number	Nutrient Database Serving Portion [A]	Serving weight	Consumption Northeast
				(grams)	*(servings/person/yr)*
Plantain	P	09277	1/2 cup sliced	74	0.21
Plum	P	09279	1/2 cup slices	83	0.04
Plum- babyfood	P	09279	1/2 cup slices	83	0.00
Plum, prune, dried	P	09291	1/4 cup pitted	43	1.22
Plum, prune, fresh	P	09291	1/4 cup pitted	43	0.67
Plum, prune, fresh- babyfood	P	09291	1/4 cup pitted	43	0.00
SUBTOTAL - Processed					**56.12**
Apple, juice	P	09016	6 fluid oz	186	44.74
Apple, juice	F	09016	6 fluid oz	186	1.44
Apple, juice - babyfood	P	09016	6 fluid oz	186	0.03
Apricot, juice	P	09036	6 fluid oz	188	0.14
Apricot, juice- babyfood	P	09036	6 fluid oz	188	0.00
Cherry, juice	P	NL [D]	6 fluid oz	186	0.30
Grape, juice	P	09135	6 fluid oz	190	19.50
Grape, juice- babyfood	P	09135	6 fluid oz	190	0.00
Mango, juice	P	NL [D]	6 fluid oz	186	0.16
Mango, juice - babyfood	P	NL [D]	6 fluid oz	186	0.00
Papaya, juice	P	09229	6 fluid oz	188	0.00
Passionfruit, juice	P	09232	6 fluid oz	185	0.06
Peach, juice	P	09251	6 fluid oz	187	0.92
Pear, juice	P	09262	6 fluid oz	188	0.91
Pear, juice- babyfood	P	09262	6 fluid oz	188	0.00
Pineapple, juice	P	09273	6 fluid oz	188	5.16
Pineapple, juice- babyfood	P	09273	6 fluid oz	188	0.00
Plum, prune, juice	P	09294	6 fluid oz	192	1.76
SUBTOTAL - Juice					**75.12**

Appendix 2. Average annual per capita consumption of fruit in the Northeast (servings basis), 1994-96 (continued).

F = Fresh.

P = Processed (includes canned, dried, frozen, and other processed forms).

NL = Not listed in the Nutrient Database for Standard Reference.

[A] Weights of a serving determined from Nutrient Database for Standard Reference (NDB) (USDA Agricultural Research Service, 2001).

[B] Weight of a serving estimated using average of dried apples, apricots, bananas, dates, figs, grapes, peaches, pears, plums, and Zante currants.

[C] Weight of a serving estimated using average of blackberries, blueberries, boysenberries, cranberries, gooseberries, raspberries, and strawberries.

[D] Weight of a serving estimated using average of apple, apricot, grape, grapefruit, lemon, lime, orange, papaya, passionfruit, peach, pear, pineapple, and prune juices.

Sources: Derived from US Environmental Protection Agency and USDA Agricultural Research Service (2000) and USDA Agricultural Research Service (2001).

Appendix 3. Average annual acreage, yield, production, and utilization of fruit crops in New York State, 1994-98.

Fruit crop [A]	Acres [B]	Yield [C]	Production [D]
	(lbs)	*(lbs/ac)*	*(lbs)*
Apples	56,400	18,865	1,064,000,000
Fresh use	NA	NA	482,000,000
Canned	NA	NA	296,200,000
Juice/Cider	NA	NA	197,400,000
Frozen	NA	NA	63,400,000
Other processed	NA	NA	25,000,000
Apricots	45	2,971	133,696
Blackberries	64	1,755	112,328
Blueberries	662	1,994	1,320,000
Cantaloupe	376	8,000	3,008,000
Cherries, sweet	580	2,545	1,476,000
Cherries, tart	3,340	4,988	16,660,000
Fresh use	NA	NA	180,000
Processed	NA	NA	16,480,000
Currants	3	483	1,450
Grapes	32,400	9,827	318,400,000
Fresh use	NA	NA	6,800,000
Juice	NA	NA	203,200,000
Wine	NA	NA	108,400,000
Honeydew melon	28	12,000	336,000
Nectarines	49	9,244	452,955
Other berries	2	1,260	2,520
Peaches	1,600	6,188	9,900,000
Pears	2,260	11,239	25,400,000
Plums and prunes	337	4,913	1,655,812
Red raspberries	450	2,244	1,010,000
Strawberries	1,980	3,788	7,500,000
Watermelon	107	12,000	1,284,000

NA = Data not available.
[A] Data for crops in regular font are 5-year averages from New York Agricultural Statistics. Data for crops in italics are point estimates from the 1997 Census of Agriculture.
[B] Acres of bearing age for berries, grapes, and tree fruits. Harvested acres for melons.
[C] Yields for berried, grapes, and tree fruits are derived based on average production and acreage for 1994-98. Yield estimates for melons are from Zanstra and Price (1988).
[D] The Census of Agriculture only reports harvested acreage for melons. Production was calculated based on harvested acreage from the Census and yield estimates from Zandstra and Price (1988).

Sources: Derived from New York Agricultural Statistics Service, 1999; USDA National Agricultural Statistics Service, 1999; and Zandstra and Price, 1988.

Appendix 4. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating consumable equivalent production from farm gate production.

Fruit Commodity	5 - Year Average Production [D]	Farm weight to processed weight	Loss from Primary to Consumer weight	Retail loss	Nonedible share	Foodservice and Consumer loss	Consumable Equivalent Production [E]
	(lbs)	*(conversion factor)*	*(percent loss)*				
FRESH							
Apples	482,000,000	N/A	4%	2%	8%	30%	292,031,846
Apricots	133,696	N/A	9%	2%	7%	30%	77,619
Blackberries	112,328	N/A	7%	2%	4%	30%	68,796
Blueberries	1,320,000	N/A	7%	2%	2%	30%	825,291
Cantaloupe	3,008,000	N/A	8%	2%	49%	30%	968,189
Cherries, sweet	1,476,000	N/A	8%	2%	10%	30%	838,380
Cherries, tart	180,000	N/A	8%	2%	10%	30%	102,241
Currants	1,450	N/A	7%	2%	2%	30%	907
Grapes	6,800,000	N/A	9%	2%	4%	30%	4,075,169
Honeydew melon	336,000	N/A	8%	2%	54%	30%	97,546
Nectarines	452,955	N/A	5%	2%	11%	30%	262,720
Other berries	2,520	N/A	7%	1%	0%	15%	1,972
Peaches	9,900,000	N/A	5%	2%	11%	30%	5,742,129
Pears	25,400,000	N/A	5%	2%	8%	30%	15,228,926
Plums and prunes	1,655,812	N/A	5%	2%	6%	30%	1,014,347
Red raspberries	1,010,000	N/A	7%	2%	4%	30%	618,585
Strawberries	7,500,000	N/A	8%	2%	6%	30%	4,449,396
Watermelon	1,284,000	N/A	10%	2%	48%	30%	412,226

Appendix 4. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating consumable equivalent production from farm gate production (continued).

Fruit Commodity	5 - Year Average Production [D]	Farm weight to processed weight	Loss from Primary to Consumer weight	Retail loss	Nonedible share	Foodservice and Consumer loss	Consumable Equivalent Production [E]
	(lbs)	*(conversion factor)*	*(percent loss)*				
PROCESSED							
Apples (canned) [F]	296,200,000	0.80	0%	1%	0%	15%	199,401,840
Apples (frozen)	63,400,000	0.60	0%	1%	0%	15%	32,010,660
Apples (juice/cider)	197,400,000	0.73	0%	1%	0%	15%	121,815,540
Cherries, tart (processed) [G]	16,480,000	0.93	0%	1%	0%	15%	12,827,826
Grapes (juice)	203,200,000	0.81	0%	1%	0%	15%	138,348,720
TOTALS	**1,319,252,761**						**831,220,871**

N/A = not applicable.
[A] Conversion factors for estimating product weight from farm gate weight derived from USDA Economic Research Service (1992).
[B] Loss estimates (loss from primary to consumer weight, retail loss, foodservice and consumer loss) are from Kantor (1998). Loss estimates for fresh blackberries, blueberries, currants, and red raspberries are the average values for all fresh fruits listed in Kantor.
[C] Estimates of non-edible share for most crops are from Kantor (1998). Estimates for fresh blackberries, blueberries, currants, and red raspberries are from Matthews and Garrison (1975).
[D] See Appendix 3 for more information on farm gate production.
[E] Consumable equivalent production calculated by multiplying farm gate production by the product of all conversion and loss factors (loss factor = 1- percent loss).
[F] Assumes applesauce is the predominant form of canned apple.
[G] Assumes processed cherries includes both canned and frozen forms.

Sources: Derived from New York Agricultural Statistics Service (1999), National Agricultural Statistics Service (1999), Kantor (1998), Economic Research Service (1992), Matthews and Garrison (1975), and Zandstra and Price (1988).

Appendix 5. Servings of fruit produced in New York State, annual average, 1994-98.

Fruit Commodity [A]	Nutrient Database Number	Nutrient Database Serving Portion [B]	Serving weight	Production [C]
			(g)	*(servings)*
CITRUS, BERRIES & MELONS				
Blackberries	09042	1/2 cup	72	433,800
Blueberries	09050	1/2 cup	73	5,168,029
Cantaloupe	09181	1/2 cup balls, 1/2 cup cubes, 1/2 cup diced	82	5,349,586
Currants	NL [D]	1/2 cup	68	6,062
Honeydew melon	09184	1/2 cup balls, 1/2 cup cubes	87	510,500
Other berries	NL [D]	1/2 cup	68	13,186
Red raspberries	09302	1/2 cup	62	4,566,468
Strawberries	09316	1/2 cup halves, 1/2 cup sliced, 1/2 cup whole	77	26,234,101
Watermelon	09326	1/2 cup balls, 1/2 cup diced	77	2,446,411
SUBTOTAL				**44,728,142**
OTHER NON-CITRUS				
Apples (fresh use)	09003	1/2 cup chopped or 1/2 cup slices (average)	59	2,256,722,694
Apples (canned)	09019	1/2 cup	122	748,529,174
Apples (frozen)	09014	1/2 cup slices	94	154,913,335
Apples (juice/cider)	09016	6 fluid oz	186	300,037,748
Apricots	09021	1/2 cup	80	440,487
Cherries, sweet	09063, 09070	1/2 cup, without pits	75	5,074,992
Cherries, tart (fresh)	09063, 09070	1/2 cup, without pits	75	618,902
Cherries, tart (processed)	09063, 09070	1/2 cup, without pits	75	74,125,327
Grapes (fresh)	09132	1/2 cup, seedless	80	23,126,586
Grapes (juice)	09135	6 fluid oz	190	293,981,355
Nectarines	09191	1/2 cup slices	69	1,728,620
Peaches	09236	1/2 cup slices	85	30,669,723

Appendix 5. Servings of fruit produced in New York State, annual average, 1994-98 (continued).

Fruit Commodity [A]	Nutrient Database Number	Nutrient Database Serving Portion [B]	Serving weight	Production [C]
			(g)	*(servings)*
Pears	09252	1/2 cup slices	83	83,805,239
Plums and prunes	09279	1/2 cup slices	83	5,581,983
SUBTOTAL				**3,979,356,164**
TOTALS				**4,024,084,306**

NL = Not listed in the Nutrient Database for Standard Reference

[A] Unless market channel is shown in parentheses, production data does not differentiate utilization by form. Assumed to be used for fresh market.

[B] Weights of a serving determined from Nutrient Database for Standard Reference (NDB) (USDA Agricultural Research Service, 2001).

[C] Calculated based on consumable equivalent production (see Appendix 4).

[D] Weight of a serving estimated using average of blackberries, blueberries, boysenberries, cranberries, gooseberries, raspberries, and strawberries.

Sources: Derived from New York Agricultural Statistics Service (1999), National Agricultural Statistics Service (1999), Kantor (1998), Economic Research Service (1992), Matthews and Garrison (1975), Zandstra and Price (1988), and USDA Agricultural Research Service (2001)

Appendix 6. Fruit servings consumed if all New Yorkers ate according to Food Guide Pyramid recommendations.

Gender	Age	NY Population [A]	Pyramid recommendation for Individuals	Pyramid recommendation for NYS Population
			(servings/day)	*(servings/day)*
M and F	Less than 2 yr	483,680	N/A	N/A
M and F	2 to 3 [B]	479,093	1.3	638,791
M and F	4 to 6	766,731	2.3	1,763,481
M and F	7 to 10	1,051,535	2.7	2,839,145
M	11 to 14	488,412	3.5	1,709,442
M	15 to 18	480,767	4.0	1,923,068
M	19 to 24	699,783	4.0	2,799,132
M	25 to 50	3,498,813	4.-	13,995,252
M	51+	2,180,451	3.2	6,977,443
F	11 to 14	467,436	3.0	1,402,308
F	15 to 18	458,515	3.0	1,375,545
F	19 to 24	683,734	3.0	2,051,202
F	25 to 50	3,689,476	3.0	11,068,428
F	51+	2,768,175	2.5	6,920,438
TOTALS	**All ages (2+)** [C]	**17,712,921**	**3.1**	**55,447,704**

N/A = Not applicable.
[A] Estimated population for July 1, 1999.
[B] Bowman *et al*. (1998) recommend 2 servings per day for children 2 to 3 years, but assume portion sizes are 2/3 the size of adult servings. Recommended servings shown are in adult equivalents.
[C] Individual serving recommendation is a weighted average for New York State.

Sources: Population data from US Dept. of Commerce (1999), Pyramid recommendations from Bowman *et al.* (1998).

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake.

FCID Commodity Name	Food form	Total Consumption NYS	Foodservice and consumer loss	Nonedible share	Retail loss	Loss from primary to consumer weight	Processed weight to farm weight	Farmgate equivalent consumption
		(lbs/yr)	*(percent loss)*				*(factor)*	*(lbs/yr)*
Apple, dried	P	1,506,573	15%	0%	1%	0%	8.00	13,999,081
Apple, fruit with peel	F	213,827,243	30%	8%	2%	4%	N/A	318,466,427
Apple, fruit with peel	P	15,061	15%	0%	1%	0%	1.77	30,876
Apple, juice	P	324,681,485	15%	0%	1%	0%	1.36	514,251,197
Apple, juice	F	10,452,314	15%	0%	1%	0%	1.36	16,555,040
Apple, juice - babyfood	P	194,226	15%	0%	1%	0%	1.36	307,627
Apple, peeled fruit	P	15,298,835	15%	0%	1%	0%	1.77	31,363,339
Apple, peeled fruit- babyfood	P	8,123	15%	0%	1%	0%	1.86	17,549
Apple, sauce	F	45,474,124	15%	0%	1%	0%	1.25	66,022,743
Apple, sauce	P	1,008,820	15%	0%	1%	0%	1.25	1,464,681
Apple, sauce - babyfood	P	69,683	15%	0%	1%	0%	1.25	101,171
Apricot	P	4,348,182	15%	0%	1%	0%	0.90	4,520,120
Apricot	F	132,036	30%	7%	2%	9%	N/A	204,196
Apricot- babyfood	P	3,829	15%	0%	1%	0%	0.69	3,069
Apricot, dried	P	1,007,812	15%	0%	1%	0%	5.56	6,508,391
Apricot, juice [D]	P	1,049,030	15%	0%	1%	0%	1.42	1,732,363
Apricot, juice- babyfood [D]	P	3,225	15%	0%	1%	0%	1.42	5,325
Banana	F	243,489,193	30%	36%	2%	0%	N/A	439,098,672
Banana [E]	P	4,224,294	15%	0%	1%	0%	1.56	7,666,433
Banana- babyfood [E]	P	34,940	15%	0%	1%	0%	1.56	63,410
Banana, dried [F]	P	186,912	15%	0%	1%	0%	5.77	1,252,389
Banana, dried- babyfood [F]	P	98,458	15%	0%	1%	0%	5.77	659,709
Blackberry	P	2,253,148	15%	0%	1%	0%	0.85	2,224,477
Blackberry	F	86,706	30%	4%	2%	5%	N/A	125,816
Blackberry, juice [D]	P	507,263	15%	0%	1%	0%	1.42	837,692

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake (continued).

FCID Commodity Name	Food form	Total Consumption NYS	Foodservice and consumer loss	Nonedible share	Retail loss	Loss from primary to consumer weight	Processed weight to farm weight	Farmgate equivalent consumption
		(lbs/yr)	*(percent loss)*				*(factor)*	*(lbs/yr)*
Blueberry	P	9,080,657	15%	0%	1%	0%	0.94	9,861,616
Blueberry	F	5,055,864	30%	2%	2%	5%	N/A	7,195,260
Blueberry- babyfood	P	6,248	15%	0%	1%	0%	0.94	6,785
Boysenberry	P	139,674	15%	0%	1%	0%	0.92	148,442
Cantaloupe	F	71,616,347	30%	49%	2%	8%	N/A	152,814,903
Cantaloupe [E]	P	182,792	15%	0%	1%	0%	1.96	416,299
Casaba	F	1,667,858	30%	40%	2%	5%	N/A	3,257,903
Cherry	F	3,753,117	30%	10%	2%	8%	N/A	5,912,240
Cherry	P	2,770,645	15%	0%	1%	0%	1.09	3,515,779
Cherry- babyfood	P	1,451	15%	0%	1%	0%	1.04	1,753
Cherry, juice [D]	P	2,160,089	15%	0%	1%	0%	1.42	3,567,162
Cranberry	P	3,583,571	15%	0%	1%	0%	0.39	1,623,304
Cranberry	F	73,691	30%	5%	2%	4%	N/A	106,704
Cranberry, dried [F]	P	190,010	15%	0%	1%	0%	5.77	1,273,144
Cranberry, juice [D]	P	60,293,759	15%	0%	1%	0%	1.42	99,568,884
Currant, dried [F]	P	864	15%	0%	1%	0%	5.77	5,791
Date	P	737,642	15%	0%	1%	0%	1.14	976,719
Fig	F	271,206	30%	1%	2%	5%	N/A	382,183
Fig, dried	P	2,208,964	15%	0%	1%	0%	2.94	7,543,194
Gooseberry	P	14	15%	0%	1%	0%	0.60	10
Grape	F	59,252,428	30%	4%	2%	9%	N/A	89,065,501
Grape	P	5,070,407	15%	0%	1%	0%	1.18	6,949,348
Grape, juice	P	144,259,853	15%	0%	1%	0%	1.24	207,093,934
Grape, juice- babyfood	P	32,485	15%	0%	1%	0%	1.24	46,634
Grape, raisin	P	19,174,268	15%	0%	1%	0%	4.72	105,044,467

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake (continued).

FCID Commodity Name	Food form	Total Consumption NYS	Foodservice and consumer loss	Nonedible share	Retail loss	Loss from primary to consumer weight	Processed weight to farm weight	Farmgate equivalent consumption
		(lbs/yr)	*(percent loss)*				*(factor)*	*(lbs/yr)*
Grape, raisin	F	268,772	15%	0%	1%	0%	4.72	1,472,441
Grapefruit	F	51,975,799	30%	50%	2%	3%	N/A	106,481,260
Grapefruit	P	872,700	15%	0%	1%	0%	2.02	2,047,556
Grapefruit, juice	P	71,544,931	15%	0%	1%	0%	2.07	171,929,871
Grapefruit, juice	P	619,680	15%	0%	1%	0%	2.07	1,489,156
Guava [E]	P	476,921	15%	0%	1%	0%	1.25	692,429
Honeydew melon	F	24,373,237	30%	54%	2%	8%	N/A	53,752,815
Huckleberry [G]	P	42	15%	0%	1%	0%	0.87	42
Kiwifruit	F	3,436,569	30%	14%	2%	0%	N/A	5,194,855
Lemon	F	6,217,042	30%	47%	2%	4%	N/A	12,603,118
Lemon	P	590	15%	0%	1%	0%	2.10	1,440
Lemon, juice	P	32,481,187	15%	0%	1%	0%	2.99	112,747,055
Lemon, juice	F	3,994,288	15%	0%	1%	0%	2.99	13,864,771
Lime	F	297,029	30%	16%	2%	4%	N/A	475,153
Lime, juice [H]	P	4,720,870	15%	0%	1%	0%	2.30	12,605,267
Lime, juice [H]	F	30,937	15%	0%	1%	0%	2.30	82,604
Mango	F	6,326,617	30%	31%	2%	0%	N/A	10,989,714
Mango [E]	P	10,053	15%	0%	1%	0%	1.45	16,922
Mango- babyfood [E]	P	1,129	15%	0%	1%	0%	1.45	1,900
Mango, juice [D]	P	1,145,325	15%	0%	1%	0%	1.42	1,891,385
Mango, juice - babyfood [D]	P	843	15%	0%	1%	0%	1.42	1,391
Nectarine	F	13,010,182	30%	11%	2%	5%	N/A	20,106,625
Orange	F	101,849,776	30%	27%	2%	3%	N/A	176,662,571
Orange	P	67,834	15%	0%	1%	0%	2.22	174,912

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake (continued).

FCID Commodity Name	Food form	Total Consumption NYS	Foodservice and consumer loss	Nonedible share	Retail loss	Loss from primary to consumer weight	Processed weight to farm weight	Farmgate equivalent consumption
		(lbs/yr)	*(percent loss)*				*(factor)*	*(lbs/yr)*
Orange, juice	P	1,131,104,592	15%	0%	1%	0%	1.84	2,416,143,417
Orange, juice	P	19,282,319	15%	0%	1%	0%	1.84	41,188,806
Orange, juice- babyfood	F	169,799	15%	0%	1%	0%	1.84	362,706
Papaya	F	387,013	30%	33%	2%	0%	N/A	682,528
Papaya [E]	P	313,912	15%	0%	1%	0%	1.49	544,192
Papaya, dried [F]	P	209,301	15%	0%	1%	0%	5.77	1,402,401
Papaya, juice [D]	P	8,960	15%	0%	1%	0%	1.42	14,796
Passionfruit, juice [D]	P	427,812	15%	0%	1%	0%	1.42	706,488
Peach	F	36,419,309	30%	11%	2%	5%	N/A	56,284,331
Peach	P	23,827,716	15%	0%	1%	0%	1.09	30,166,722
Peach- babyfood	P	168,779	15%	0%	1%	0%	0.93	182,314
Peach, dried	P	209,720	15%	0%	1%	0%	6.32	1,540,298
Peach, juice [D]	P	6,670,839	15%	0%	1%	0%	1.42	11,016,198
Pear	F	43,964,087	30%	8%	2%	5%	N/A	66,108,094
Pear	P	15,418,450	15%	0%	1%	0%	1.00	17,908,530
Pear- babyfood	P	132,731	15%	0%	1%	0%	1.00	154,167
Pear, dried	D	216,747	15%	0%	1%	0%	6.31	1,588,551
Pear, juice [D]	P	6,644,349	15%	0%	1%	0%	1.42	10,972,453
Pear, juice- babyfood [D]	P	5,341	15%	0%	1%	0%	1.42	8,820
Pineapple	P	13,256,873	15%	0%	1%	0%	1.66	25,483,454
Pineapple	F	7,426,988	30%	48%	2%	5%	N/A	15,304,082
Pineapple- babyfood	P	2,015	15%	0%	1%	0%	1.71	4,003
Pineapple, dried [F]	P	209,301	15%	0%	1%	0%	5.77	1,402,401
Pineapple, juice	P	37,734,422	15%	0%	1%	0%	1.70	74,707,724

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake (continued).

FCID Commodity Name	Food form	Total Consumption NYS	Foodservice and consumer loss	Nonedible share	Retail loss	Loss from primary to consumer weight	Processed weight to farm weight	Farmgate equivalent consumption
		(lbs/yr)	*(percent loss)*				*(factor)*	*(lbs/yr)*
Pineapple, juice- babyfood	P	16,236	15%	0%	1%	0%	1.70	32,144
Plantain	F	45,380,312	30%	36%	2%	0%	N/A	81,837,039
Plantain [E]	P	616,771	15%	0%	1%	0%	1.56	1,119,342
Plum	F	8,997,482	30%	6%	2%	5%	N/A	13,278,826
Plum	P	134,043	15%	0%	1%	0%	0.92	143,236
Plum- babyfood	P	4,031	15%	0%	1%	0%	0.66	3,090
Plum, prune, dried	P	2,021,274	15%	0%	1%	0%	2.83	6,632,282
Plum, prune, fresh	P	1,116,392	15%	0%	1%	0%	2.83	3,663,147
Plum, prune, fresh- babyfood	P	1,854	15%	0%	1%	0%	2.83	6,084
Plum, prune, juice	P	13,180,531	15%	0%	1%	0%	1.38	21,172,280
Raspberry	P	5,767,141	15%	0%	1%	0%	0.85	5,660,261
Raspberry	F	1,723,086	30%	4%	2%	5%	N/A	2,500,296
Raspberry- babyfood	P	645	15%	0%	1%	0%	0.64	479
Raspberry, juice [D]	P	550,058	15%	0%	1%	0%	1.42	908,363
Strawberry	F	32,458,443	30%	6%	2%	8%	N/A	49,272,072
Strawberry	P	15,450,574	15%	0%	1%	0%	0.81	14,536,131
Strawberry, juice [D]	P	23,520,128	15%	0%	1%	0%	1.42	38,841,050
Tangerine	F	7,322,533	30%	28%	2%	5%	N/A	13,049,809
Tangerine	P	606,604	15%	0%	1%	0%	2.10	1,479,598
Tangerine, juice [H]	F	1,596,387	15%	0%	1%	0%	2.30	4,262,536
Watermelon	F	98,649,465	30%	48%	2%	10%	N/A	212,957,362
Watermelon, juice [D]	P	1,427,408	15%	0%	1%	0%	1.42	2,357,217
TOTALS	**All**	**3,190,020,543**						**6,086,735,126**

Appendix 7. Conversion factors[A], loss estimates[B], and non-edible[C] share values for calculating farm gate equivalent consumption from food intake (continued)

F = Fresh.

P = Processed (includes canned, dried, frozen, and other processed types).

N/A = Not applicable.

[A] Conversion factors for estimating product weight from farmgate weight derived from USDA Economic Research Service (1992).

[B] Loss estimates (loss from primary to consumer weight, retail loss, foodservice and consumer loss) are from Kantor (1998). For commodities not reported in Kantor (1998), the value shown is either the average loss reported for fresh fruits or the average loss reported for processed fruits, according to the form consumed.

[C] Estimates of non-edible share for most crops are from Kantor (1998). Estimates for crops not reported in Kantor are from Matthews and Garrison (1975).

[D] Estimated conversion factor using average of non-citrus juices.

[E] No fresh to processed conversion available. Used the ratio of total weight / edible weight to estimate this conversion.

[F] Estimated conversion factor using average of all dried fruit.

[G] Estimated conversion factor using average of all canned and frozen berries.

[H] Estimated conversion factor using average of citrus juices

Sources: Derived from US Environmental Protection Agency and USDA Agricultural Research Service (2000), Kantor (1998), Economic Research Service (1992), Matthews and Garrison (1975).

Appendix 8. Fruit commodity groups used in this study and the commodities they represent from production and consumption data sets.

Fruit commodity group	Production data [A]	FCID [B]
	commodity name	*commodity name*
Apples (fresh)	*Apples (fresh use)*	Apple, fruit with peel
Apples (juice)	*Apples (juice/cider)*	Apple, juice; Apple, juice - babyfood
Apples (processed)	*Apples (canned), Apples (frozen)*	Apple, dried; Apple, fruit with peel; Apple, peeled fruit; Apple, peeled fruit- babyfood; Apple, sauce; Apple, sauce - babyfood
Apricot (juice)	N/A	Apricot, juice; Apricot, juice- babyfood
Apricots (fresh)	Apricots	Apricot
Apricots (other processed)	N/A	Apricot; Apricot- babyfood; Apricot, dried
Bananas (fresh)	N/A	Banana
Bananas (other processed)	N/A	Banana; Banana- babyfood; Banana, dried; Banana, dried- babyfood
Blackberries (fresh)	Blackberries	Blackberry
Blackberries (other processed)	N/A	Blackberry
Blackberry (juice)	N/A	Blackberry, juice
Blueberries (fresh)	*Blueberries*	Blueberry
Blueberries (other processed)	N/A	Blueberry; Blueberry- babyfood
Boysenberries (other processed)	N/A	Boysenberry
Cantaloupe (fresh)	Cantaloupe	Cantaloupe
Cantaloupe (other processed)	N/A	Cantaloupe
Casaba (fresh)	N/A	Casaba
Cherries (fresh)	*Cherries, sweet (fresh), Cherries, tart (fresh)*	Cherry
Cherries (other processed)	*Cherries, tart (processed)*	Cherry; Cherry- babyfood
Cherry (juice)	N/A	Cherry, juice
Cranberries (fresh)	N/A	Cranberry
Cranberries (juice)	N/A	Cranberry, juice
Cranberries (other processed)	N/A	Cranberry; Cranberry, dried
Currants (other processed)	N/A	Currant, dried
Dates (other processed)	N/A	Date

Appendix 8. Fruit commodity groups used in this study and the commodities they represent from production and consumption data sets (continued).

Fruit commodity group	Production data [A]	FCID [B]
	commodity name	*commodity name*
Figs (fresh)	N/A	Fig
Figs (other processed)	N/A	Fig, dried
Gooseberries (other processed)	N/A	Gooseberry
Grapefruit (fresh)	N/A	Grapefruit
Grapefruit (other processed)	N/A	Grapefruit
Grapefuit (juice)	N/A	Grapefruit, juice
Grapes (fresh)	*Grapes (fresh)*	Grape
Grapes (juice)	*Grapes (juice)*	Grape, juice; Grape, juice- babyfood
Grapes (other processed)	N/A	Grape; Grape, raisin
Guava (other processed)	N/A	Guava
Honeydew melon (fresh)	Honeydew melon	Honeydew melon
Huckleberries (other processed)	N/A	Huckleberry
Kiwifruit (fresh)	N/A	Kiwifruit
Lemon (juice)	N/A	Lemon, juice
Lemons (fresh)	N/A	Lemon
Lemons (other processed)	N/A	Lemon
Lime (juice)	N/A	Lime, juice
Limes (fresh)	N/A	Lime
Mango (juice)	N/A	Mango, juice; Mango, juice - babyfood
Mangos (fresh)	N/A	Mango
Mangos (other processed)	N/A	Mango; Mango- babyfood
Nectarines (fresh)	Nectarines	Nectarine
Oranges (fresh)	N/A	Orange
Oranges (juice)	N/A	Orange, juice; Orange, juice- babyfood
Oranges (other processed)	N/A	Orange
Other fruit	Currants, Other berries	
Papaya (juice)	N/A	Papaya, juice
Papayas (fresh)	N/A	Papaya
Papayas (other processed)	N/A	Papaya; Papaya, dried

Appendix 8. Fruit commodity groups used in this study and the commodities they represent from production and consumption data sets (continued).

Fruit commodity group	Production data [A]	FCID [B]
	commodity name	*commodity name*
Passionfruit (juice)	N/A	Passionfruit, juice
Peach (juice)	N/A	Peach, juice
Peaches (fresh)	*Peaches*	Peach
Peaches (other processed)	N/A	Peach; Peach- babyfood; Peach, dried
Pear (juice)	N/A	Pear, juice; Pear, juice- babyfood
Pears (fresh)	*Pears*	Pear
Pears (other processed)	N/A	Pear; Pear- babyfood; Pear, dried
Pineapple (juice)	N/A	Pineapple, juice; Pineapple, juice- babyfood
Pineapples (fresh)	N/A	Pineapple
Pineapples (other processed)	N/A	Pineapple; Pineapple- babyfood; Pineapple, dried
Plantains (fresh)	N/A	Plantain
Plantains (other processed)	N/A	Plantain
Plums (fresh)	Plums and prunes	Plum
Plums (other processed)	N/A	Plum; Plum- babyfood; Plum, prune, dried; Plum, prune, fresh; Plum, prune, fresh- babyfood
Prune (juice)	N/A	Plum, prune, juice
Raspberries (fresh)	*Red raspberries*	Raspberry
Raspberries (other processed)	N/A	Raspberry; Raspberry- babyfood
Raspberry (juice)	N/A	Raspberry, juice
Strawberries (fresh)	*Strawberries*	Strawberry
Strawberries (other processed)	N/A	Strawberry
Strawberry (juice)	N/A	Strawberry, juice
Tangerine (juice)	N/A	Tangerine, juice
Tangerines (fresh)	N/A	Tangerine
Tangerines (other processed)	N/A	Tangerine
Watermelon (fresh)	Watermelon	Watermelon
Watermelon (juice)	N/A	Watermelon, juice

Appendix 8. Fruit commodity groups used in this study and the commodities they represent from production and consumption data sets (continued).

N/A = Not applicable.

[A] Italicized commodity names are from New York Agricultural Statistics Service (1999), those in regular typeface are from USDA National Agricultural Statistics Service (1999). Parenthesized words indicate the market channel in which production is used.

[B] Commodity names from Food Commodity Intake Database (FCID), Version 2.1 (U.S. Environmental Protection Agency and USDA Agricultural Research Service, 2000). Names for commodities consumed in both fresh and processed forms appear twice. The FCID commodity "Banana", for example, is listed under both "Bananas (fresh)" and "Bananas (processed)".

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