7-2003

Checking the Food Odometer: Comparing Food Miles for Local versus Conventional Produce Sales to Iowa Institutions

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Abstract
This analysis found that locally grown produce traveled an average of 56 miles from farm to point of sale, compared to an average of 1,494 miles for 30 types of produce from conventional sources.

Keywords
Food miles food pathways food system assessments

Disciplines
Bioresource and Agricultural Engineering | Horticulture | Operations and Supply Chain Management

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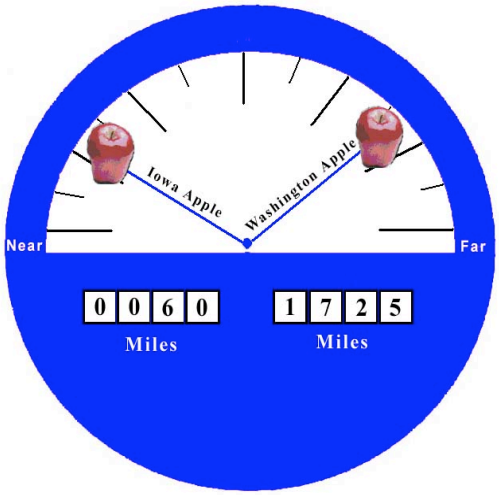

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July 2003
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Abstract

Food miles are the distance food travels from where it is grown to where it is ultimately purchased or consumed by the end user. The term food miles has become part of the vernacular among food system professionals when describing the farm to consumer pathways of food. A Weighted Average Source Distance (WASD) can be used to calculate food miles by combining information on the distances from production to point of sale and the amount of food product transported. This paper calculates the WASD or food miles for various types of fresh produce delivered to Iowa institutions from local sources. The data is compared to food miles calculated from an interpolation of conventional sources within the continental United States – the likely places these products would have originated from had local food not been available. The average WASD for locally grown produce to reach institutional markets was 56 miles, while the conventional WASD for the produce to reach those same institutional points of sale was 1,494 miles, nearly 27 times further. Conventional produce items traveled from eight (pumpkins) to 92 (broccoli) times farther than the local produce to reach the points of sale. Research is underway to determine how well consumers understand and value the concept of food miles within the context of their food purchase decisions.

Acknowledgements

The authors wish to thank the following people for their contributions to this paper:
Mary Adams – Leopold Center, for reviewing and editing the manuscript
Rick Hartmann – Practical Farmers of Iowa, for providing the institutional local food sales data
Lisa Ann Helland and Sara Johnson – ISU Students, for assistance with the "food odometer"
Andrew Hug – Leopold Center, for reviewing the manuscript
Barbara Maxwell – USDA Agricultural Marketing Service, for providing produce arrival data
Oksana Yakhnenko – Leopold Center, for help with charts and figures

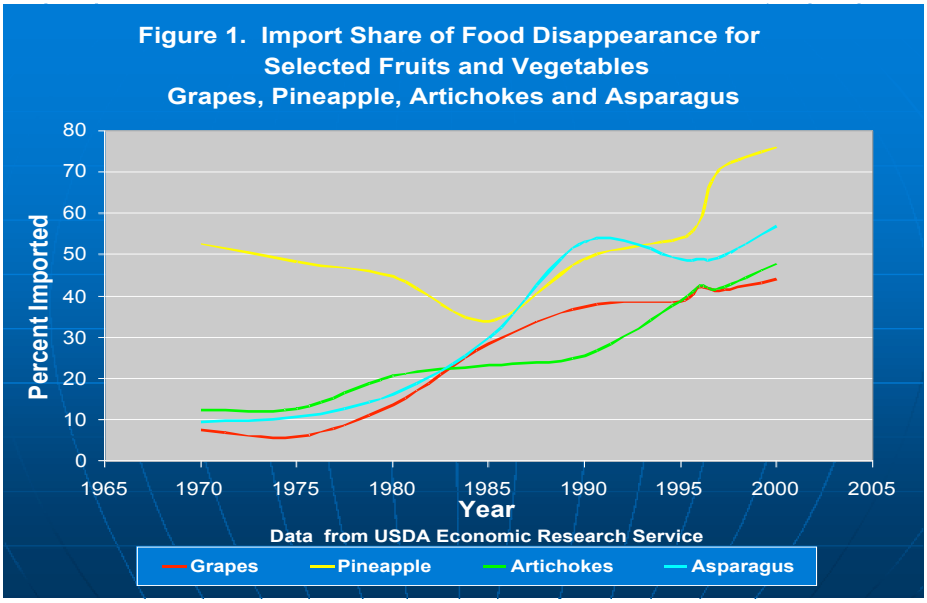
Introduction

How far does food travel? The concept of food miles

Food miles are the distance food travels from where it is grown to where it is ultimately purchased or consumed by the end user. The term food miles has become part of the vernacular among food system professionals when describing the farm to consumer pathways of food. One 1969 national U.S. estimate of food miles traveled cited an average distance of 1,346 miles.[1] Calculations made by John Hendrickson using a 1980 study examining transportation and fuel requirements estimated that fresh produce traveled 1,500 miles.[2]

In developed, industrial nations, food appears to be traveling farther to reach consumers. The inference is that many industrialized countries no longer rely on their own farmers to fully supply a number of food items. International food trade is increasing more rapidly than increases in population or food production. Between 1968 and 1998, world food production increased by 84 percent, population by 91 percent, while food trade increased 184 percent.[3] An increasing proportion of what Americans eat is produced in other countries, including an estimated 39 percent of fruits, 12 percent of vegetables, 40 percent of lamb, and 78 percent of fish and shellfish in 2001.[4] The typical American prepared meal contains, on average, ingredients from at least five countries outside the United States.[5]

Examination of food imports (import share of food disappearance for foods) from the USDA Economic Research Service database reveals that the amount of imported produce consumed by Americans has been rising since 1970, which implies that the average food miles for a number of produce items has been increasing over time. This shift can be viewed in Figure 1.



[1] U.S. Department of Energy. 1969. *U.S. Agriculture: Potential Vulnerabilities*. Stanford Research Insitute, Menlo Park, CA.

[2] Hendrickson, John. 1996. "Energy use in the U.S. food system: A summary of existing research and analysis." Sustainable Farming-REAP-Canada. Ste. Anne-de'Bellevue, Quebec. Vol 7, No 4. Fall 1997.

[3] Based on data from FAO Food Balance Sheet Database 2001.

[4] USDA Economic Research Service. "Import share of food disappearance for selected foods, selected years." Web site July 2003 (http://www.ers.usda.gov/data/foodconsumption/datasystem.asp). Fruit data includes bananas.

[5] Lang, Tim. 2001. "Food Safety and Public Health: Will the Crisis Ever End?" Cardiff Law School Public Lecture Series: 4. Thames Valley University.

Within industrial nations such as Great Britain and the United States, food appears to be traveling farther to reach the consumer. Between 1978 and 1999, food transport distances within Great Britain increased by 50 percent.[6] Fresh produce arriving by truck at the Chicago Terminal Market from within the continental United States traveled an average one-way distance of 1,518 miles in 1998, a 22 percent increase over the 1,245 miles traveled in 1981.[7]

Calculating food miles: Using weighted average source distances (WASD)

A Weighted Average Source Distance (WASD) is used to calculate a single distance figure that combines information on the distances from production to point of sale and the amount of food product transported.[8] The formula for the WASD is:

$$WASD = \frac{\sum (m(k) \times d(k))}{\sum m(k)}$$

where:
k = different location points of the production
m = weight (amount) from each point of production, and
d = distance from each point of production to each point of use (or sale).

Several U.S. food system researchers have used the WASD equation above to calculate food miles. In 1997, fresh produce arriving at the Jessup, Maryland Terminal Market traveled an average one-way distance of 1,686 miles from the state of production to Maryland.[9] Produce arrival data for the Chicago Terminal Market for 1998 also was used to calculate WASDs for 30 produce items. Only pumpkins and mushrooms traveled less than 500 miles to reach the Chicago market, while six fruits and vegetables (broccoli, cauliflower, table grapes, green peas, spinach, and lettuce) traveled over 2,000 miles to reach their destination.[10]

In *Food, Fuel and Freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions,* the authors calculated a WASD for a small sample of food sales data (meat and fresh produce) across three local food projects sponsored by the Leopold Center. In these projects producers served institutional markets such as conference centers, hospitals, and university facilities. The food traveled nearly 45 miles from farm to point of sale across these systems, compared to an estimated 1,546 miles had these food items originated from conventional sources across the country. Due to the small size of the data set in that study, the WASD was not calculated for specific produce types. To calculate the WASD for conventional sources within the United States supplying these meat and produce items in place of local sources, the authors assumed the production origin was a state that supplies Iowa with a significant amount of that food item.

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[6] Jones, J. A., 1999. The environmental impacts of distributing consumer goods: a case study on desert apples. Unpublished Ph.D. thesis.
[7] Pirog, R., T. Van Pelt, K. Enshayan, and E. Cook. 2001. *Food, Fuel, and Freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions.* Leopold Center for Sustainable Agriculture, Ames, Iowa.
[8] Carlsson-Kanyama, Annika. 1997. Weighted average source points and distances for consumption origin-tools for environmental impact analysis. *Ecological Economics* 23(1997): 15-23.
[9] Hora, Matthew, and Jody Tick. 2001. From Farm to Table: Making the Connection in the Mid-Atlantic Food System. Capital Area Food Bank, Washington, D.C.
[10] Pirog, R., and T. Van Pelt. 2002. *How far do your fruit and vegetables travel?* Leopold Letter Vol. 14, No. 1. Spring 2002.

This paper will calculate the WASD or food miles for various types of fresh produce delivered to institutions from local sources in Iowa. This data will be compared to food miles from an interpolation of conventional sources supplying those same institutions from within the continental United States.

Comparison of food miles – local versus conventional source estimate

Methods - Locally grown data

Food distribution records collected by Practical Farmers of Iowa (PFI) for brokering "all-Iowa" meals in 2001 were used in this study. Data were selected from sales transactions of 16 different locally grown fruits and vegetables from 34 Iowa farms sold to 23 different conference centers, hotels, and other institutions in central Iowa. Specific data used included total pounds of product delivered, delivery location, and address of grower. One-way distance from the farm to the institution was estimated using the Internet site Mapquest (mapquest.com). Some farm to institution distances were adjusted because the farm had the same town or city address as the institution (example: one farm had an Ames address but was approximately four miles from the point of sale).

All PFI-brokered produce shipments not in pounds were converted to pounds by using the weights, measures, and conversion factors from the United States Department of Agriculture *Agricultural Statistics 2000* (page V) or the *Iowa Commercial Horticulture Survey: Edible Food Crops* (July, 2002: pages a5-a6). The USDA data can also be found at the website *http://www.usda.gov/nass/pubs/agr00/00_intro.pdf*.

Methods - Conventional source estimations

The USDA's Agricultural Marketing Service (AMS) tracks shipments and imports/exports of fresh fruits and vegetables by commodities, modes of transportation, origins, and months in the calendar year. The AMS also tracked produce arrivals at various terminal markets throughout the United States until budget limitations forced the elimination of this data collection in 1998.[11] Terminal markets for produce have declined in importance in the United States; in 2001 there were only 22 major terminal markets that handle an estimated 30 percent of the volume of the nation's produce.[12] The decline in terminal market share is a reflection of the increased purchasing power of integrated wholesale-retail buying entities representing national/international grocery chains.[13]

Although terminal market share has declined, the arrival data collected through 1998 provide a realistic picture of where produce comes from during the calendar year. Our goal was to provide a realistic estimate of where the produce items purchased locally in the PFI data set would have originated from had they come from conventional sources within the continental United States, and use those new distances to calculate a conventionally sourced WASD. (We chose to exclude import arrival data in our WASD calculations because of the difficulty in estimating specific routes for these produce items to reach the point of sale.) To do this we combined USDA's Agricultural Marketing Service (AMS) arrival data for produce from the Chicago and St. Louis Terminal Markets to determine a state of origin for the same 16 produce items had they not been provided by the local sources. For our estimations, state of origin needed to have a combined total of at least 50

[11] Edwards, Douglas. USDA Agricultural Marketing Service, February 2001. Personal communication.
[12] Cook, Roberta. 2001. "The Dynamic U.S. Fresh Produce Industry: An Industry in Transition." *Postharvest Technology of Horticultural Crops*, Third Edition. Adel A. Kader. University of California Division of Agriculture and Natural Resources.
[13] ibid.

percent of the arrival amount for that specific produce type. If the combined total was less than 50 percent, additional states were added as states of origin until we accounted for at least 50 percent. We also checked USDA AMS Fresh Fruit and Vegetable Shipment data[14] to see if our choices appeared consistent with produce arrival data (arrival location is not included in the AMS shipment data set). The conventional WASD calculations estimated distances from the production origin within the continental United States to the point of sale used in the locally grown data across all produce types for each sales transaction. We chose a city in the center of each state (or states, if the production total was not at least 50 percent) as the production origin. Then we calculated a one-way road distance from the production origin(s) to the point of sale used in the locally grown data set using the Internet site Mapquest (mapquest.com). We assumed that conventionally sourced produce traveled directly to the point of sale, although it likely made at least one stop at a distribution center, which might have slightly increased or decreased the farm to point of sale distance.

Discussion

Using the information on transport distance and weights of product delivered, we calculated a WASD for each and across all 16 locally grown and conventionally sourced produce items.. Table 1 compares the WASD for the locally grown data with the conventional WASD for each and across all 16 produce types:

Table 1. Comparison of local versus conventional source WASD (food miles) for produce

Produce Type	**Locally grown**	**Conventional Source Estimation**
	WASD (miles)	**WASD (miles)**
Apples	61	1,726
Beans	65	1,313
Broccoli	20	1,846
Cabbage	50	719
Carrots	27	1,838
Corn, Sweet	20	1,426
Garlic	31	1,811
Lettuce	43	1,823
Onions	35	1,759
Peppers	44	1,589
Potatoes	75	1,155
Pumpkins	41	311
Spinach	36	1,815
Squash	52	1,277
Strawberries	56	1,830
Tomatoes	60	1,569
WASD - for all produce	56	1,494
Sum of all WASDs	716	25,301

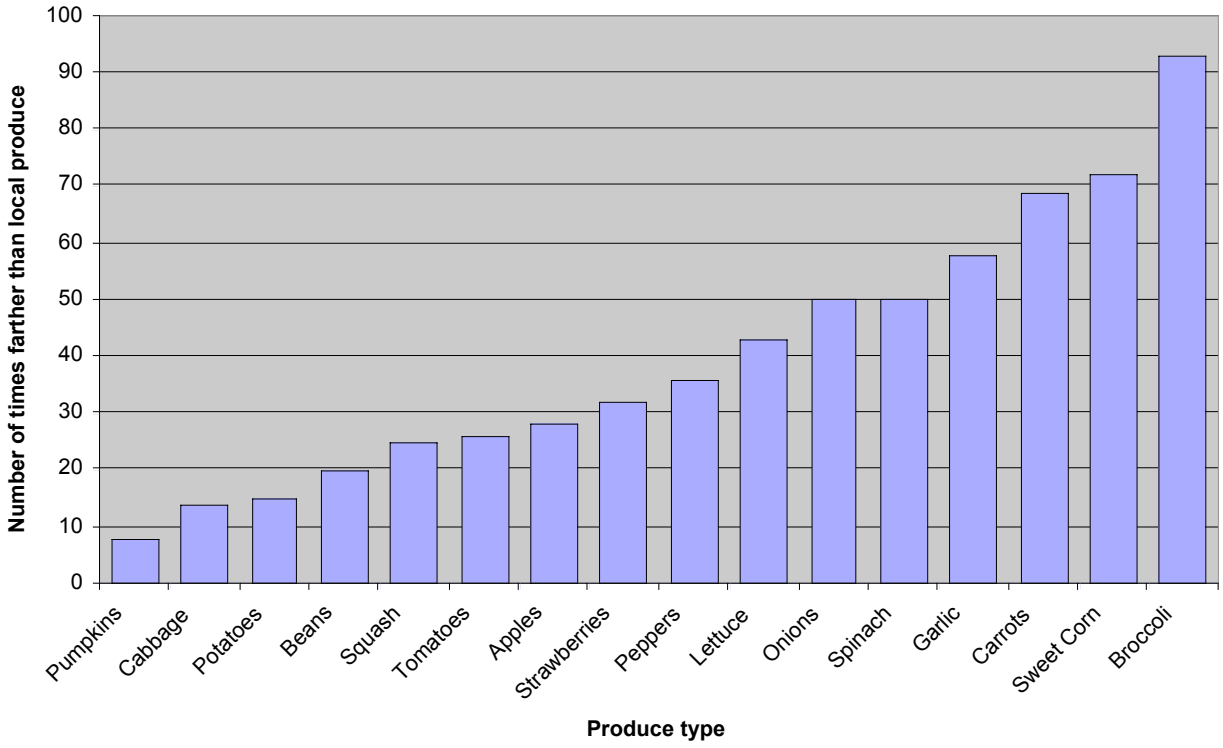
Local WASD distances ranged from 20 miles for broccoli and sweet corn to 75 miles for potatoes. Conventional WASD distances ranged from 311 miles for pumpkins to 1,838 miles for carrots. The average WASD distance for locally grown produce to reach institutional markets was 56 miles,

[14] Found at http://www.ams.usda.gov/fv/mncs/shipsumm01.pdf

while the conventional source WASD for the produce to reach those same institutional points of sale was 1,494 miles, nearly 27 times further. The sum of all WASDs for the 16 produce types to reach institutions was 716 miles for the locally grown data set; slightly less than the distance from Des Moines, Iowa, to Denver, Colorado. The sum of all WASDs for the 16 produce types to reach the same institutional markets was 25,301 miles for the conventional source estimations; which is the distance from Des Moines north (longitudinally) to the North Pole, south to the South Pole and back to Des Moines, with an additional 439 miles of travel north to within 70 miles of the Canadian border.

Another way of expressing the difference in food miles between the local and conventional data set is to divide the conventional WASD mileage for each produce type by the locally grown WASD for the same produce item, as shown in Figure 2.

Figure 2. How much farther does conventional produce travel than local produce?



Note: Local produce data from 2001 Practical Farmers Of Iowa "All Iowa Meals". Conventional source data derived by interpolating USDA AMS produce arrival data

Conventional source broccoli traveled more than 90 times further than locally sourced broccoli, while carrots, sweet corn, garlic, onions, and spinach all traveled at least 50 times further than their locally grown counterparts. Conventional source pumpkins, cabbage, and potatoes traveled 8 to 15 times further than their locally grown counterparts. In the case of the potatoes, the locally grown WASD was the greatest of all local produce distances; in the case of pumpkins the conventional source estimation WASD was the shortest distance of all the conventional source produce items.

It is highly likely that the conventional source food miles for certain produce types would be greater if imports from other countries were included in the calculation. For example, if New Zealand apples were included in the mix, the resulting WASD calculation (with Iowa as a destination) for conventional apples would be greater than the 1,726 miles shown in this paper. For other produce items where a significant percentage of the produce item originates from Mexico, the resulting WASD (with Iowa as a destination) may be similar or slightly lower.

Implications and future research

Recent media and grassroots interest in using food miles as a metaphor to explain several benefits associated with local food systems suggests an opportunity for producer groups, local food brokers, educators, and local food system project coordinators to use food miles in market messages. These groups can collect easily obtainable data and calculate the WASD to estimate food miles for the products they provide. Food miles may be useful in their market messages to explain how their products differ from those in the conventional system. They also could be used by local organic growers to further differentiate their product from organic foods originating from other countries or states. Groups should consider using food miles along with mode of distribution (truck, plane, rail, ship) if they want to provide consumers with a relative indicator of fuel used and CO_2 emissions during food transport.[15] The primary author is currently leading a study to determine how well consumers understand and value the concept of food miles within the context of their food purchase decisions. Preliminary findings suggest that consumers may be more interested in the concept if it is expressed relative to how food miles may affect product freshness, quality, and taste.[16]

[15] Pirog, Rich, and Patrick Schuh. 2002. "The load less traveled: examining the potential of using food miles in ecolabels." Proceedings from Ecolabels and the Greening of the Food Market Conference, November, 2002. p. 69.

[16] This observation is based on focus groups conducted in June/July 2003 in Ames, Cedar Rapids, and Des Moines, Iowa.