Da' Good Ol' Days: Potato Norms of Yesterday vs. Those of Today

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Introduction

The scientific method has grown up around the idea that progress comes from both trial and error and that the key to future success is often found in a reappraisal of the past. This report is based on a wide-ranging survey of scientific and popular publications regarding potatoes, their production and the development of value-added products, such as French fries. Tremendous progress has been made in potato cultivation and product development through scientific research. It is informative—and often amusing—to revisit the potato norms of the past to see how far we've come, as well as to get a glimpse of where we need to go from here.

The First Dehydrated Potatoes

It all began with the ancient Peruvians. Fossil potatoes found in Peru suggest that potato cultivation began some 7,000 to 10,000 years ago.[1] From archeological evidence we know that the Ancient Indians of Peru dehydrated potatoes by freezing them at night, then thawing them during the day; "juice was expressed from the thawed potatoes by treading on them with bare feet." Repeat until you have dehydrated potatoes! This provided a buffer against years of low yields.

Potato Migration

With the Spanish Conquest, the potato spread from the Americas to Europe, but there was a significant lag time before Europeans decided they could actually eat the tubers. One story (probably apocryphal) has it that it wasn't until Marie Antoinette wore potato flowers in her hair that folks decided it was OK to consume spuds. Be that as it may, by the eighteenth century potato cultivation was on the rise and on the move. Seed potatoes came with colonists to the British New World and helped to establish New England as the center of North American potato cultivation, a status it would maintain until well into the twentieth century.

Irish Potato Famine

Scientific research centered on the development of new varieties was stimulated by the Irish Potato Famine of the 1840s. By the late 1830s almost the only variety of potato being grown in Ireland was the Lumper, a "watery" (i.e., low specific gravity) spud that was none too nutritious. Diaries from that period indicate that a grown man might eat six pounds of potatoes (cooked in milk thinned with water) for dinner. By one means or another, late blight (*P. infestans*) crossed the Atlantic and destroyed potato crops for several years running in the early 1840s, not only in Ireland but in much of the rest of Europe as well. For various economic and political reasons, though, Ireland was the hardest hit: about one million Irish died of starvation while another million migrated out of the country, mostly to the United States. The devastation caused by late blight inspired a new generation of agronomists to develop blight-resistant potato varieties. In the U.S., "[t]he first potato-breeding work… started" in the late 1840s, "when late blight was destroying crops in many European countries and causing large losses in this country" (*USDA Yearbook* 1947:328).

[1] "Ancient Peruvians loved their spuds." Maggie Fox. http://www.abc.net.au/science/news/stories/s1474174.htm
Talburt: Potato Processing, 1975

Land Grant Colleges and Extension System Created
One good idea often gives rise to another: soon after potato breeding was approached in a scientific manner, President Abraham Lincoln in 1862 established the USDA. Lincoln appointed a man named Isaac Newton as the first Commissioner of Agriculture. In that same year Congress passed the Morrill Act, which established the nation's network of land-grant colleges and universities. The promotion of a practical education, including the agricultural and mechanical sciences, was viewed as "a key asset in achieving for the United States a vibrant agricultural economy, a prominent position in world trade, significant rural development, healthy families and communities, and the increasingly sustainable natural resource base that are characteristic of 'the great American Society'" (Adelaja: Ag. and Resource Econ. Rev.; Oct. 2003). Twenty years later Congress acted again with the Hatch Act of 1887, which established agricultural research stations in every state, while the Smith-Lever Act of 1914 established the Cooperative Extension System. The underlying premise of all three acts was that a well-educated farmer is one who produces more while using less, an idea that is the forerunner of contemporary "best management practices."

Russet Burbank Is Developed
One of Luther Burbank's early forays into plant breeding ended up providing potato growers with a kind of gold standard, the Russet Burbank. In 1871 Burbank found a seed ball on one of his "Early Rose" potato plants in New England garden. By 1874 one seed from that original ball had proved to be the progenitor of a hardy new variety. Burbank sold the new variety to a New England entrepreneur, J.H. Gregory, for $150. Gregory gave the new variety an appropriate name, Burbank Seedling. With his $150 in hand, the young horticulturist moved to California along with ten tubers of the newly named Burbank Seedling. Around 1910, a grower in Colorado noticed a sport of the normally white-skinned Burbank Seedling: the skin was darker and netted. The rest, of course, is history, as this sport was the great grand daddy of the robust Russet Burbank. (Aristocrat in Burlap)

Potato Production Moves West to Washington State
The turn of the century brought another change in American potato cultivation. The long dominance of New England was slowly eroding as more and more people moved west. They brought with them the rapidly accumulating knowledge contributed to farmers by scientists through the land-grant school and Extension bureaus. By 1899 the northern Midwest was producing the bulk of the American potato crop; fifty years later southern Idaho and southern California were the focus points of cultivation (Figures 1-4). At mid-century, Washington State, always a small but steady producer, leapt onto the world stage thanks to the construction of the Grand Coulee Dam and the opening of the state's Columbia Basin to irrigated agriculture. Water began flowing into the Basin from the Dam in 1948, with irrigation beginning in 1952.

The Columbia Basin's agricultural success was due to a nexus of engineering prowess, scientific plant-breeding projects, and a by-then 50-year-old insistence on disease-free potato seed. In 1945, 26 percent of certified seed in the U.S. were varieties that had been released since 1932 (*USDA Yearbook* 1947:332), while by 1962 "more than half the potatoes grown in" the U.S. "were varieties produced by the Federal-State breeding work [that were] unknown 30 years earlier" (*USDA Yearbook* 1962:131).

New Potato Varieties Lead to Increased Yields and Quality
New disease-resistant varieties and high-quality disease-free seed combined to dramatically increase potato yields per acre while reducing the amount of land under cultivation (Figures 5-6). Over the course of the twentieth century, yields per acre have increased nearly 600 percent while the area under production has been cut nearly in half. Additionally, the century saw the total number of farms decline sharply, especially between 1935 and 1974, while the total acreage of land under cultivation remained steady. During that same century-long period, total U.S. production of potatoes increased by about 250 percent.

Falling Potato Prices Now Leveling Out?
With all the advances in technology, equipment, varieties and agronomy, along with the resulting forces of supply and demand, potato prices have fallen to an all time low (Figures 7-8). Based on 1910 prices, potato growers in Washington State now receive around $0.30/Cwt vs. $1.40/Cwt in 1910. Although prices have been on a steady decline, the year to year reductions are not as severe or volatile as they once were. Moreover, Washington prices almost appear to be leveling out (Figure 7). Factors such as forward-contracting and improved storage, shipping, and communications are several likely reasons why price fluctuations are less than they used to be. Additionally, exports and imports of potato products have both increased over time (Figures 9-10). To the benefit of the American farmer, the quantity of exports is dramatically higher than that of imports. Foreign growth of fast-food stores such as McDonalds and Burger King, and the need for quality French fries, has likely played a large role in the export of American potatoes.

French Fry Consumption Keeps Potatoes in The American Diet
Potato processing has kept the demand for potatoes high in an era of low-carb and other fad diets. Research in potato storage has greatly contributed to the on-going utilization of potato as a staple food crop. Research in the preparation of French fries and potato chips has helped the public to recognize that it is the way potatoes are prepared, and not the tuber itself, that is the fat-bearing culprit. This is good news for growers and processors, considering that the recommended calorie daily allowance has dropped to 2,000 from a startling 3,400 in the 1950s, a decade when the only serious downturn in potato consumption occurred.

Technological Advances Lead to Economic Competitiveness
In view of increasing competition on many fronts, American scientific and engineering ingenuity have contributed to the continuing economic viability of potato cultivation. Refrigerated long-haul trucks and train cars, developed on the 1930s, enabled producers to ship to distant markets. This stands in stark contrast to the situation just a decade earlier: in the 1920s almost all potatoes were moved out of the field by horse-drawn conveyance. Two-row diggers were introduced in the ’30s as well. Indeed, the entire century is a picture of increasing economic competitiveness through the deployment of labor-saving technologies. Although no precise figures are available for potatoes, the trend is clear throughout American agriculture, such as wheat production: “The human labor used to produce 100 bushels of wheat dropped from 320 hours in 1830 to 108 hours in 1900; by 1940 a new series of improvements had reduced the labor used to 47 hours.” (*USDA Yearbook* 1947:921).

In addition to technological and variety developments that kept the competitiveness of American potato production on track, researchers also developed many chemical tools that improved fertility and battled pests and diseases. The first selective herbicide, 2,4-D, was introduced in 1946 and is today the third most widely used herbicide.

DDT was also introduced in this period, underscoring the need for carefully planned long-range studies of both efficacy and toxicity. Basic research in molecular biology contributed a deeper understanding of potato diseases, including blight and viruses, while the 1980s saw researchers beginning to open up our understanding of the potato's natural "bug busters," glycoalkoloids. In the 1990s DNA "fingerprinting" and genetic analysis began to be used for a wide variety of purposes, such as variety protection and chip-color determination. Finally, since the 1984 introduction of the personal computer every area of science and industry has been revolutionized. Digital image analysis, rapid chemical testing, satellite-guided precision agriculture and the quick dissemination and transfer of new knowledge through email and the web have and will continue to change the way we do business and research.

Similar to other industries, the potato industry is constantly changing. Technology, consumer trends, local and world events, and many other factors play a role in shaping our future. Understanding where we've been can help pave a path for the future. To prevent repeating history - at least bad history - one should look back every so often to see where we've been; the path forward will seem less cloudy.

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Figure 1. Northeast Potato Production

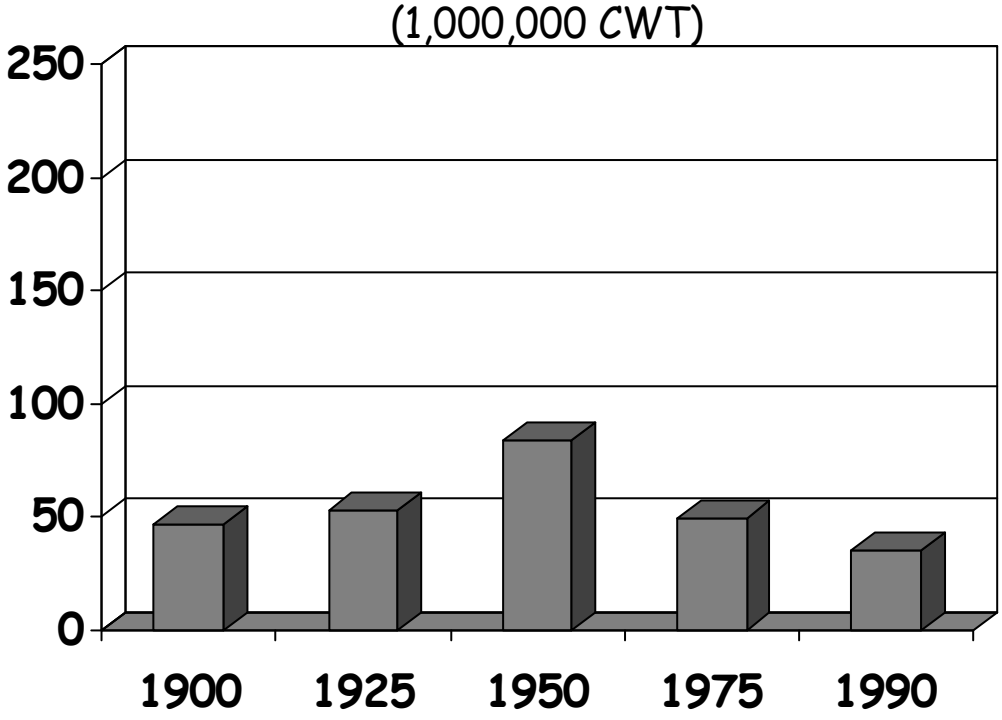

Figure 2. Midwest Potato Production

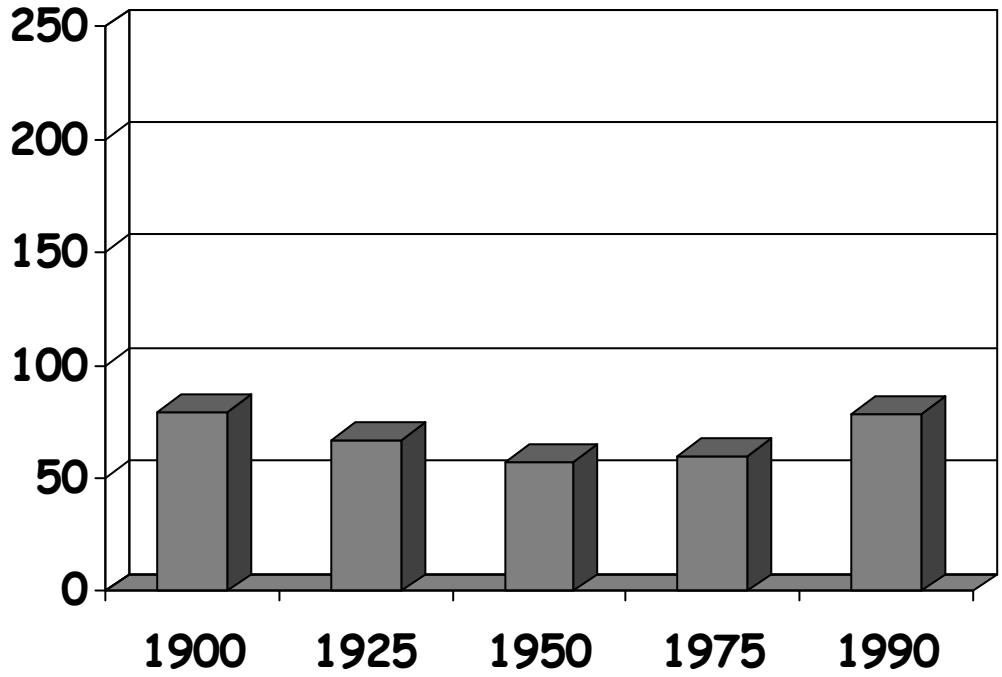

Figure 3. Pacific NW Potato Production

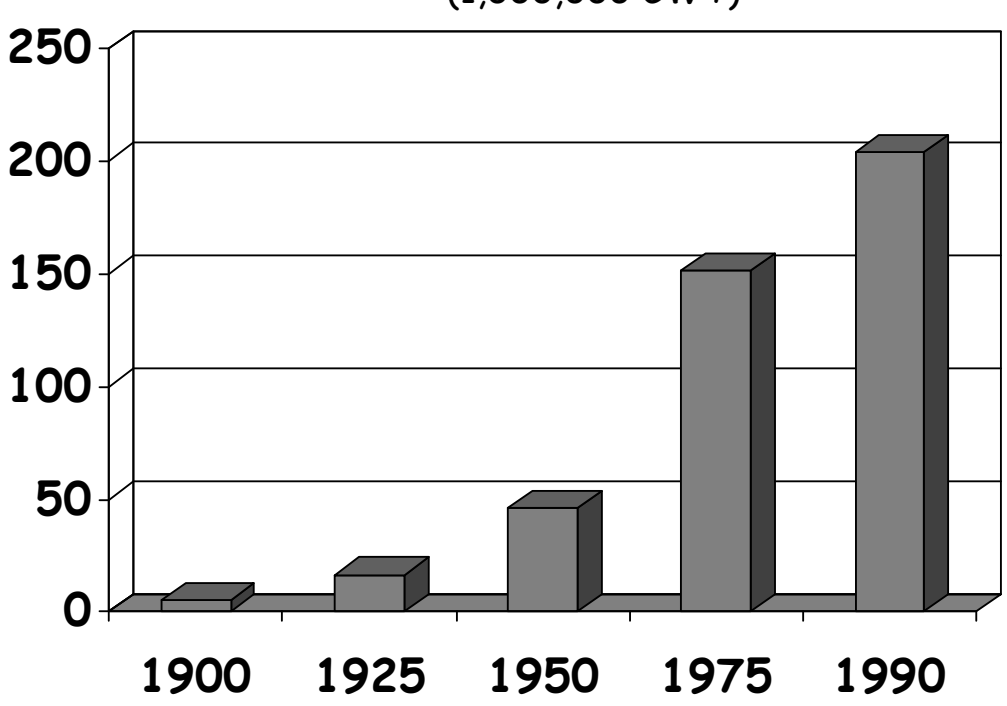

Figure 4. U.S. Potato Production

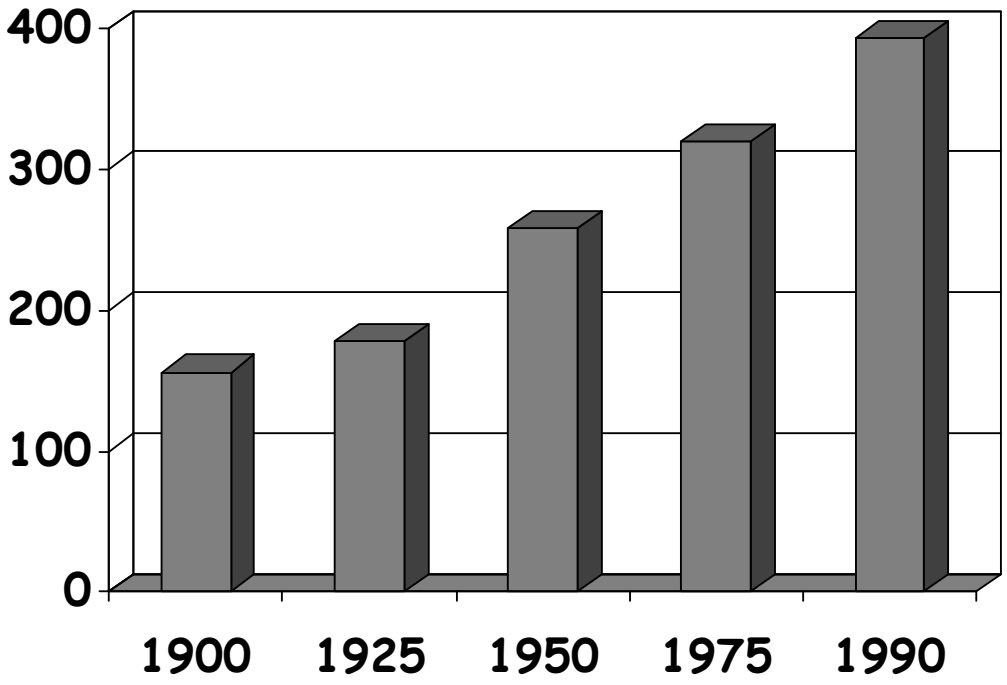

Figure 5.

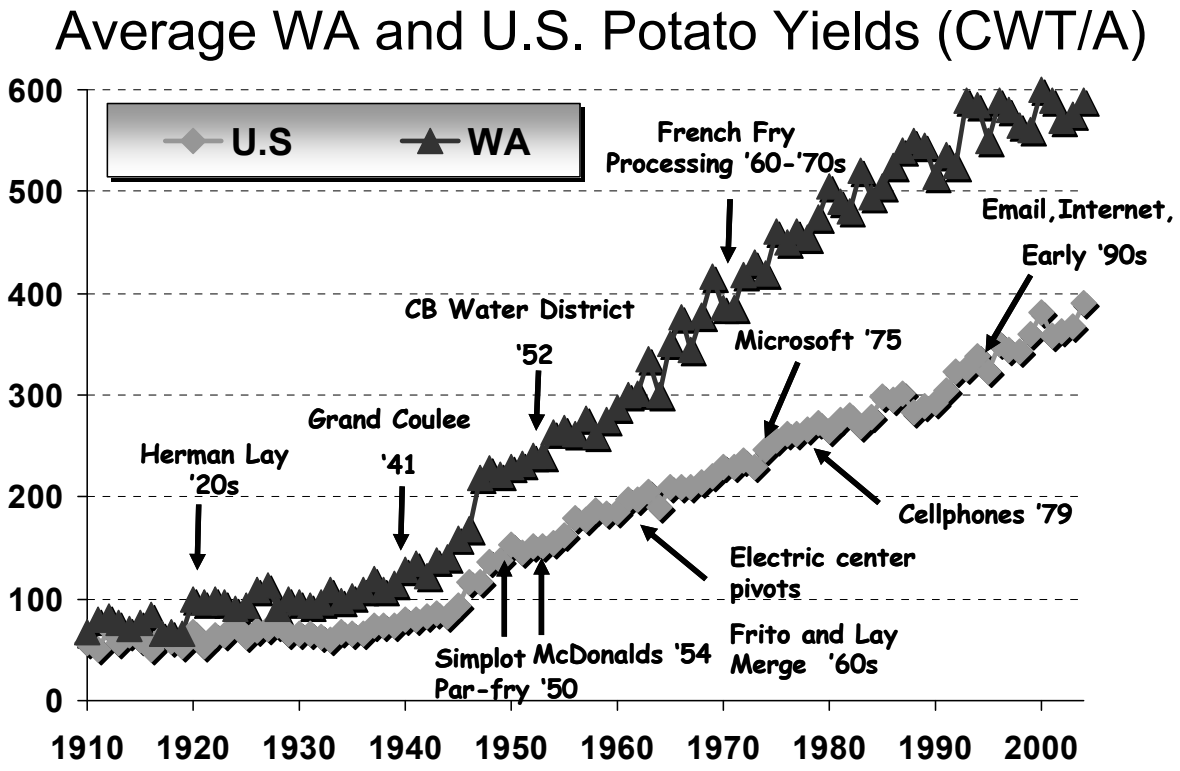

Figure 6.

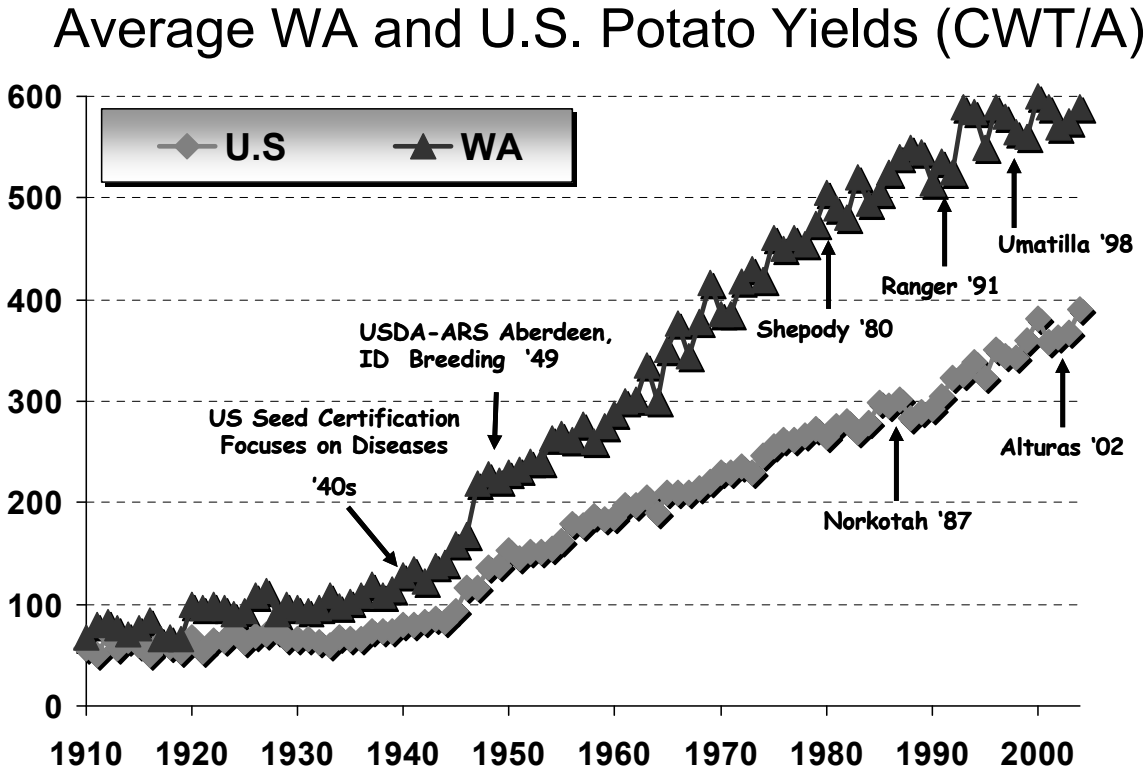

Figure 7.

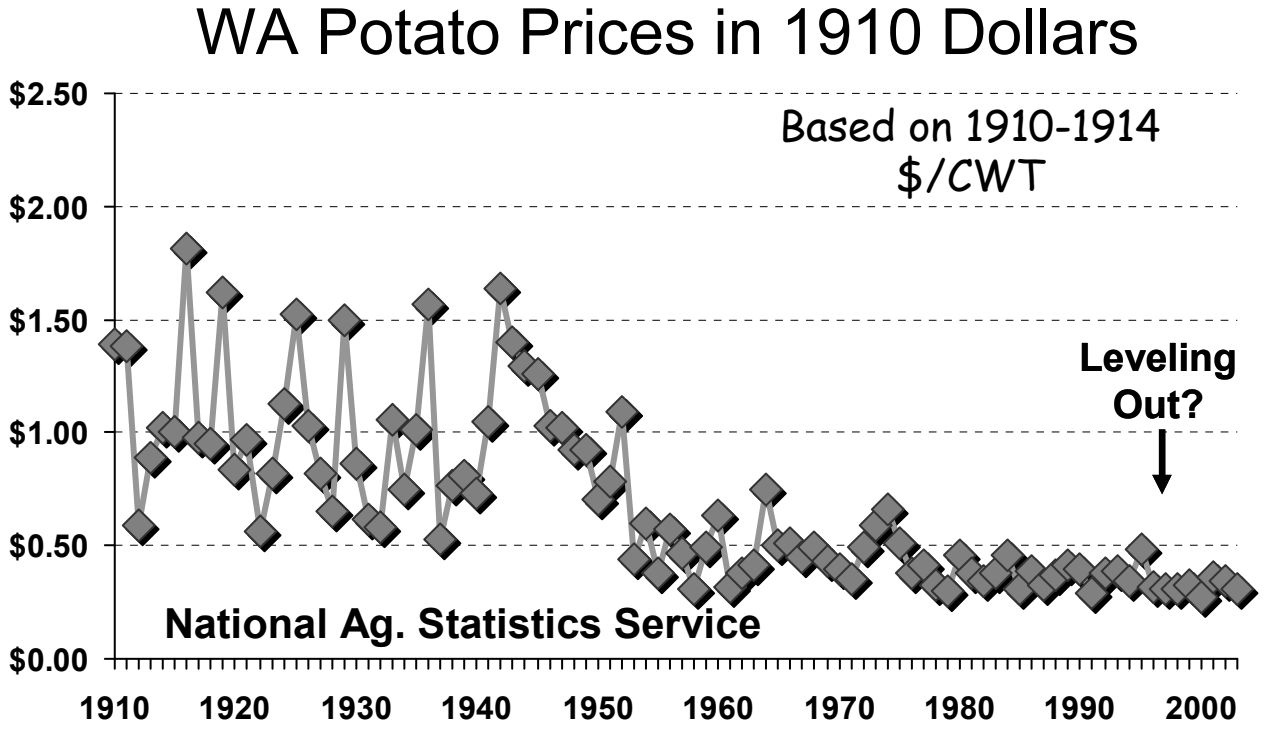

Figure 8.

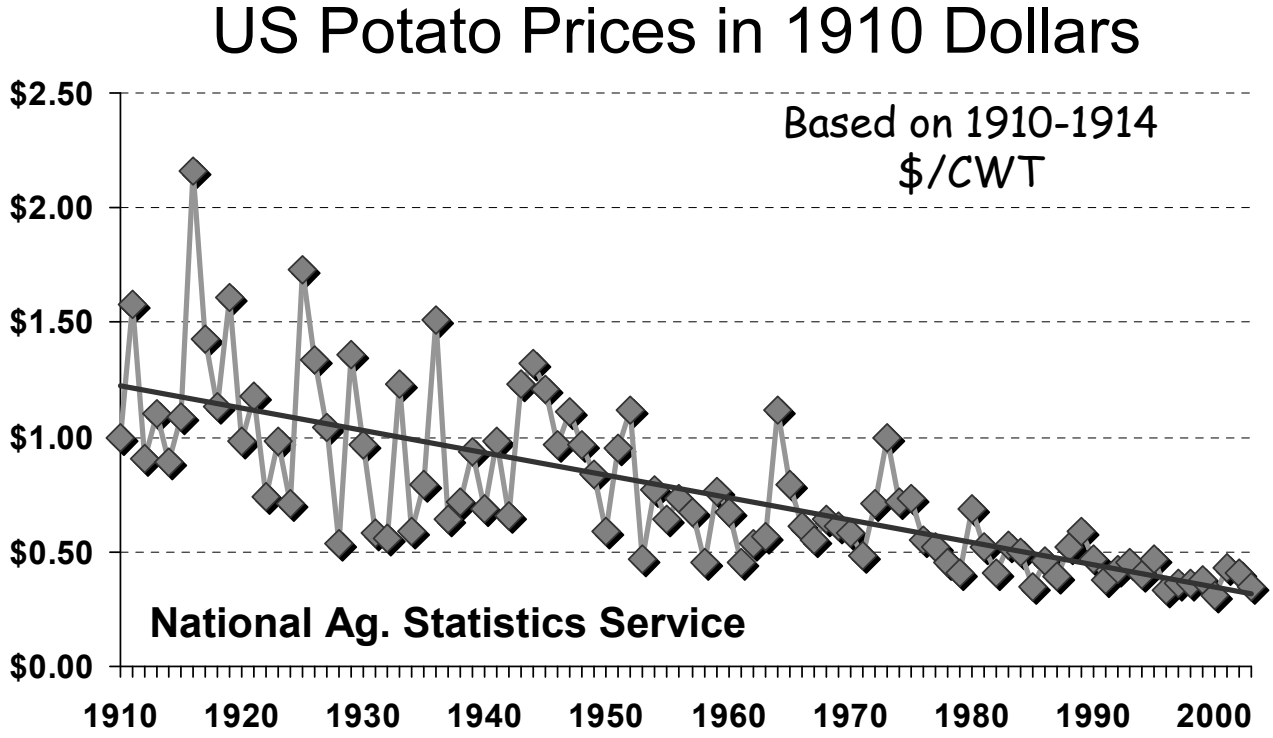

Figure 9.

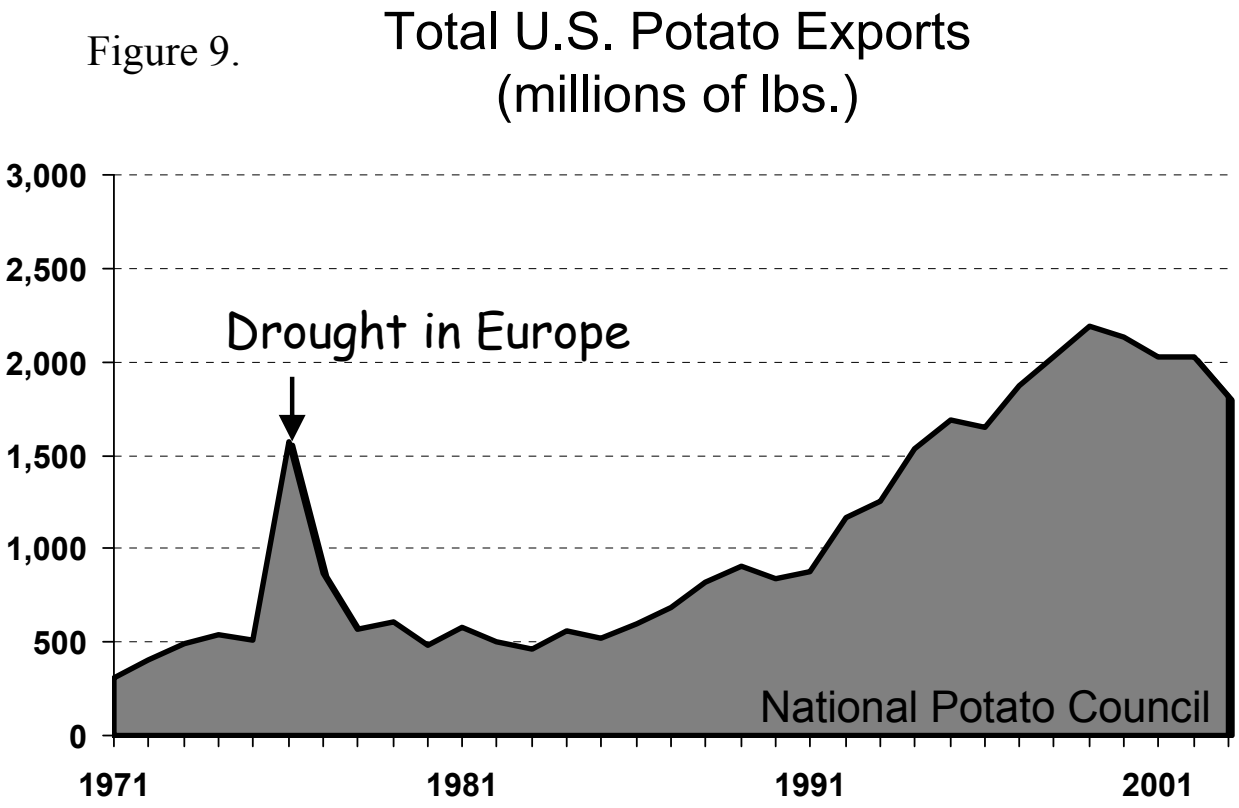

Figure 10.