

National Food Review

United States
Department of
Agriculture

Economic
Research
Service

1984
NFR-26



**Setting
Tomorrow's
Table**

Setting Tomorrow's Table

What kind and how much food will we have in the 21st century? What kind of agricultural system will be supplying our food and nonfood products? The answers may lie in today's emerging crops, new sources of food, and unique technologies.

This issue of the National Food Review looks at the likely world food situation in the decades ahead, the potential for enlarging and maintaining our food supply through aquaculture and the use of irradiation as a preservative. Changes in consumer preferences, past and future, are probed. This includes the shift to less and "lighter" fats and oils, and the greater popularity of eating out, increasingly at fast food outlets rather than traditional restaurants. Finally, there's a look at "new" crops such as jojoba, rapeseed, and other possible sources of oil products.

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Sculpture by Leo Sewell of
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Washington, D.C.

National Food Review is published each quarter by the National Economics Division of the Economic Research Service and the Information Division of the Economics Management Staff of the United States Department of Agriculture, Washington, D.C.

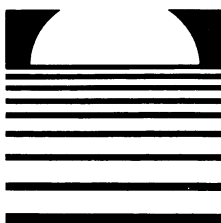
The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this publication has been approved by the Director of the Office of Management and Budget through September 30, 1985.

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Subscription price is \$8.50 a year (\$10.65 foreign). Order from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Ask for *National Food Review* and make your check payable to Superintendent of Documents. Address editorial correspondence to *National Food Review*, Room 400, GHI Bldg., ERS, USDA, Washington, D.C. 20250.

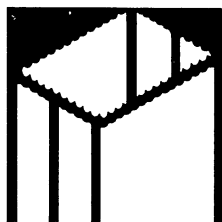
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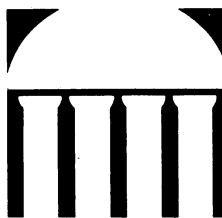
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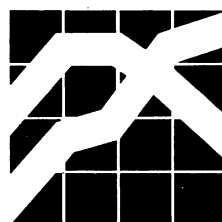
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Meeting World Food Needs

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World food consumption is expected to double over the next three decades, led by greater per capita consumption linked to rising incomes, changing tastes, and improved distribution of food to low-income people. The last doubling took 27 years. The pace will be a little slower this time because growth in world population is slowing.

It appears likely that world agriculture has the potential to meet the increased demands for food over the next three decades, according to a study by the Economic Research Service (ERS). Development of land and water resources will contribute to increased production, but most growth will be based on improved technology, increased use of purchased inputs, such as fertilizer and pesticides, development of regions that are currently below their potential, and development of farm policies and other institutional arrangements by various governments that will encourage farmers to expand output. As farmers worldwide expand production and turn increasingly to export markets, real (adjusted for inflation) food prices could decrease moderately over the long term, but become more volatile from year to year.

However, don't rule out the possibility that per capita food supplies could, instead, become relatively more scarce due to faster-than-anticipated increases in demand or slower expansion of supplies. And while governments could institute policies which help stabilize world markets and prices, the uncertainty of trends in world supply and demand reinforces the need for U.S. farm policy to be flexible enough to adapt to either contingency.

World Food Demand and Supply

Total world food consumption is determined by population and the amount eaten per person. Population growth is expected to be below the rate of the previous decades during the 1990's—around 1.6 percent per year, compared with 1.7 percent now and 1.9 percent during the 1950's and 1960's. Forecasters have suggested that if present trends continue,

world population growth may cease altogether during the 21st century. This slowdown and prospects for a gradual increase in per capita food consumption due to higher incomes and the political determination in many countries to improve diets and increase the availability of food, indicate a rise in total food use of about 2.3 percent per year, compared with 2.6 percent during the past three decades.

World food production can double to support the increased consumption even if production slows somewhat from the average growth rate of the past 30 years. World food production increased at a rate of 2.9 percent per year during the 1950's and 2.7 percent in the 1960's, rising faster than population. As a result, the amount of food available per person increased allowing for improvements in diets at favorable prices.

However, during the 1970's, bad weather and adverse economic conditions slowed the rate of growth in world food production to about 2.2 percent per year. High interest rates, increases in energy costs, and inflation followed by recession added to farmers' uncertainty and reduced incentives to expand production. Even so, world food production increased slightly faster than population during the decade. About 0.4 percent per year of the growth in output was attributable to increases in land, less than in the previous two decades. The remaining 1.8 percent per year was the result of various technical, social, and geographic factors affecting yields.

Prospects are that world agriculture can double its output during the next 30 years. To do so, longrun growth will have to be maintained at a rate slightly above the reduced rate experienced during the 1970's. This is likely to occur, even though farm prices could fall as production outpaces demand. A slower growth in demand, coupled with expanding production, further implies that world food prices will be lower relative to other items consumers buy in the decades ahead.

Domestic Situation

Population growth is slowing in the United States. Currently, it's about 0.9 percent per year and may be around 0.6 percent by 2000. By the middle of the next century, the growth rate may be close to zero, with domestic population stabilizing at just over 300 million, about one-third above the present level. The prospective growth in population alone would imply an increase of only 20 percent in the U.S. market for farm production over the next three decades.

Per capita income, and the purchasing power of that income, is expected to rise over the next three decades. The higher a family's income, the more it is likely to spend for food. However, since most people in the United States are well fed, added income might lead to only a relatively small increase in the quantity of food purchased. Changes are more likely to be in quality, packaging, or increased purchases of higher valued processed foods.

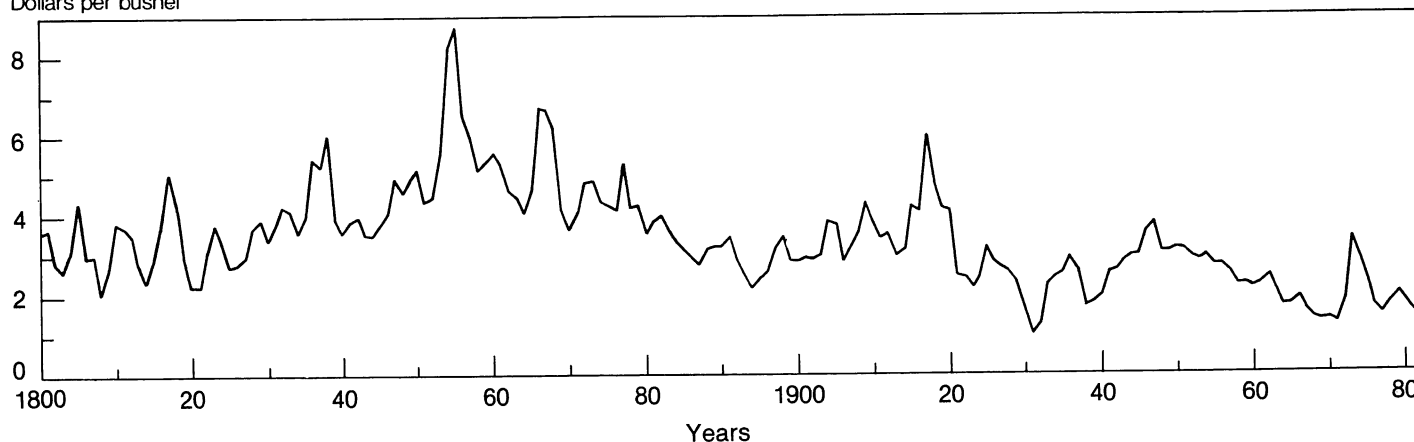
The cost of food relative to the purchasing power of an hour's work has fallen at an average rate of about 1.5 percent per year in this century as, generally, wages increased faster than food prices (*see NFR-24*). The trend has not been steady, however. Food prices, adjusted for inflation, fell rapidly during the 1930's, rose during the 1940's, and fell again during the 1950's and 1960's. The rise during the 1970's reflected our accelerating exports and therefore tighter domestic supplies. During the 1980's, food costs relative to other consumer purchases have returned to about the level of the mid-1960's.

As an illustration of the historical trend in the price of food, consider one major commodity—wheat. Figure 1 shows the farm price of wheat relative to the Consumer Price Index since 1800. Since about 1860, the overall direction in food prices has been down, except for short-term, rapid increases attributable to wars, depressions, and shortages. Thus, the food price increases of the 1970's can be seen as yet another temporary interruption in the downward movement.

Figure 1

Real Wheat Price¹

Dollars per bushel



¹In 1967 dollars.

In the next several decades, real food prices are likely to continue the pattern of the last 120 years—a decline with periodic short run swings. Lower relative food prices will improve consumer well-being in the coming decades, but not increase per capita consumption appreciably.

The net implication of the projected trends in population, income per capita, income distribution, food prices, and tastes is for around a 33-percent increase in the domestic market for food during the next three decades. U.S. agriculture can meet these demands by expanding production for domestic use by around 1 percent per year.

Future for U.S. Agriculture

U.S. farm output increased at an annual rate of 1.9 percent per year during the past three decades. At the same time, domestic markets grew relatively slowly, despite programs which supported the development of new uses for farm products and distributed food to needy persons.

As productivity outpaced domestic demand, U.S. farmers turned increasingly to export markets, particularly during the 1970's. Today, output from 40 percent of harvested acreage is exported, compared

to 20 percent a decade ago. Exports have become an important outlet for U.S. farm products, especially wheat, corn, and soybeans, which collectively account for nearly half the annual value of farm exports.

The domestic market for U.S. farm products is forecast to expand less than 1 percent per year during the next two or three decades. U.S. agricultural capacity, however, is expected to grow much faster. The resulting potential for excess supplies will encourage efforts to continue expansion of foreign markets. If exports increase at an average annual rate of about 3 percent, as is expected, output from approximately 50 percent of the acreage harvested will be exported by the year 2000. Even so, the U.S. shares of world output and trade would decrease as production worldwide expands.

Who Will Be Affected?

A future with increasing per capita world food production and decreasing relative prices received by farmers will have differing impacts on U.S. farmers, consumers, and other participants in the food production and marketing system. The relatively plentiful world food situation means U.S. export markets will grow

more slowly and the excess capacity of U.S. agriculture may become more extensive. If export growth falls to as little as 2 percent per year, the resulting greater domestic supplies will lead to even lower farm prices. While lower feed prices will benefit livestock growers, in general, extensive Federal assistance will be needed to support farmer's incomes if present farm programs remain in place. Consumers, on the other hand, will benefit from lower real food prices. The marketing sector will gain from increased trade and employment, but landowners and suppliers of farm inputs will be hurt by slower growth in farmers' demands.

Conversely, should there be an extended period of world food shortage, food prices would rise relative to other consumer purchases and the export markets for U.S. food products would grow faster. Farmers' incomes would improve and the need for Federal assistance under present price and income support programs would probably be unnecessary for most commodities. The returns would increase to suppliers of farm inputs, particularly landowners. However, consumer prices would also increase, reducing per capita consumption and decreasing the need for services for processing and marketing food products.

Issues for the 1990's

Agriculture faces a number of critical issues which will shape the 1990's and beyond. Some stem from the prospect of increasing sales by U.S. farmers into international markets where prices are likely to be volatile but declining in real terms. U.S. agriculture is expected to be able to meet the market demands placed on it by domestic and foreign markets, even though the prices farmers receive continue to decrease moderately relative to costs of production.

To maintain sufficient agricultural capacity in coming decades, however, farmers need to develop and conserve natural resources such as soil and water. Localized natural resource problems will have to be managed. Even so, development of new resources will be needed only to offset losses from agriculture to nonfarm uses so that the total availability should remain near present levels or increase only moderately.

Purchased farm inputs, including seeds, fertilizers, and machinery, will become increasingly important in determining the capacity of U.S. agriculture. The nonfarm sector appears to have the ability to satisfy these needs and the relative price paid for most is not likely to rise, except perhaps for energy-intensive inputs.

The U.S. food system, from production to consumption, uses approximately 13 percent of the nation's energy. As the price of petroleum increases relative to other production inputs during the next several decades, two adjustments can be expected. First, users will shift some of their demand for energy to other sources, such as electricity and natural gas. Liquid and gaseous synthetic fuels from coal and oil shale are some of the alternatives being considered. Gasohol is of particular interest to agriculture as a potentially expanding domestic market for grain, especially corn. However, gasohol is not com-

petitive in the marketplace and is not likely to play a major role in total energy production.

The second adjustment is continued investment in energy-conserving devices and practices which substitute relatively less expensive capital and labor for more costly fuels. These include, for example, new tractors, combines, and farm vehicles which are more energy efficient, and better application of fertilizers through sprinkler water, and minimum tillage.

Continued technological advances likely will lead to greater yields of crops and livestock, improved varieties of food products, and better production methods. Such technology will increase the importance of purchased farm inputs. Prospects for further technological change in U.S. agriculture include: genetic engineering and a new generation of more specialized and computerized machinery; remote machinery monitors, controls, and robotics; reduced-tillage and no-till practices; crops which are more pest-resistant, higher yielding, and capable of being grown in new areas; varieties with shorter growing seasons; fertilizer and pesticide encapsulation; crop hormone changes; drought resistant and salt tolerant crops; biological pest controls and vaccines; control of animal reproduction; more efficient animal feed conversion; and alternative ways to satisfy human nutrition requirements. Better access to information will aid farmers in increasing efficiency.

Policy Setting

Many organizational factors will influence the future supply of U.S. farm products. In addition to maintaining and improving the regulations affecting land and water markets, purchased farm inputs, and technical advance, new approaches will likely be offered for farm policies and trade agreements. Ways will have to be

found to expand exports, accommodate the continued downward trend in world food prices, and cope with wide shortrun fluctuations in prices and export levels as U.S. farmers turn more to international markets.

Agriculture is increasingly affected by national monetary policy, tax laws, and the level of government deficits. For example, higher interest rates dampen the demand for farm products since they increase foreign exchange rates and, thereby, raise the real price of U.S. food products in world markets. On the other hand, the supply of food may also eventually decrease as higher interest rates discourage investment in farm land and capital.

The internationalization of U.S. agriculture has changed the basis of farm policy. It has implications for the relative well-being of consumers, marketing people, farmers, input suppliers, landowners, and U.S. trading partners. In addition to continuing to cope with past issues of farm output, prices, and income, policies now must accommodate further reliance on export markets, downward pressures on real domestic prices, and a high level of uncertainty and volatility in world food trade.

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Aquaculture: Contributing to America's Food Supply

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Aquaculture—the controlled cultivation and harvest of aquatic plants and animals—is not a new idea. It dates back almost 4,000 years in Asia. However, it got started commercially in the United States only about 70 years ago, and then not primarily as a direct food source. Early efforts were in raising minnows and other small bait fish. By the early 1960's, the industry had expanded to include various fish raised for stocking farm ponds, lakes, and reservoirs. Today the U.S. aquaculture industry primarily produces fish and shellfish for human consumption, including catfish, trout, and salmon, freshwater prawns, oysters, clams, and crayfish.

In 1982, U.S. aquaculture accounted for almost 400 million pounds or about 11 percent of total edible fish and shellfish production in this country, and was valued at about \$400 million. Output was 208 percent greater than the 130 million pounds grown in 1975.

U.S. Aquaculture

Catfish culture is currently the largest aquaculture industry in the United States, with farm production totaling 220 million pounds in 1983. Commercial production began in the Southcentral United States in the 1950's. A combination of strong regional demand for catfish; suitable climate, water, and soil; producer and processor willingness to assume risk; and supporting research and extension activities of government and universities helped boost production from 5.3 million pounds in 1969. Much of this expansion has occurred in just the last 3 years, as 1983's total soared 187 percent above the 76.7 million pounds produced in 1980.

Virtually all freshwater trout marketed in the U.S. are aquaculturally grown. Preliminary data for 1982 indicate that 48 million pounds of foodsize trout valued at \$48 million were produced.

Aquaculture also produces most of our crayfish, long a Southern U.S. and European delicacy, as well as a high-value bait. In 1980, crayfish production totaled 23.9 million pounds, and estimates for 1982



indicate a jump to 55 million pounds with a farm value of \$27 million. Production has risen steadily since 1950, in response to expanded markets in New York, Chicago, and Cleveland, and other major cities. Aquaculture has enabled crayfish producers to meet this rising demand since the wild harvest tends to vary greatly from year to year due to water level fluctuations.

The production of saltwater species is less established than for freshwater types. Oysters are the one exception, with 40 percent of the U.S. supply culturally grown. In 1982, the production of cultured oysters totaled 21.7 million pounds valued at \$34 million.

Other cultivated saltwater species include salmon, hard clams, shrimp, mussels, and abalone. Of these, the salmon industry is the largest, with 25 projects active commercially, primarily in the Western States and Alaska. In addition, interest in salmon culture in New England is growing rapidly. Total production of foodsize salmon for 1982 is estimated at 25.5 million pounds.

Industry Growth

As in any emerging industry, aquaculture producers must overcome some of the most basic obstacles, including the

problems of acquiring equipment, skilled labor, and capital. In addition, technological and scientific information must be available to producers and others in the system.

A 1978 report by the National Research Council identified a number of technical impediments to expansion of aquacultural production. These included producers' continued use of wild species that are not genetically suitable for culture, incomplete understanding by producers of nutrition and diets of culturable species, continuing problems in preventing and controlling diseases, and poor knowledge of water quality criteria in culture systems. Despite Federal and State research and education programs in college and university laboratories, many of these problems still exist.

Beyond the production level, there are other concerns. A market must exist for the product, and there needs to be an adequate transportation system for shipping the perishable products. In addition, coordinated growth must take place in the production and marketing sectors. The phenomenal boom in culturally grown catfish starting in the 1970's, for example, was supported by the development of industries to supply inputs to growers and to process and distribute products.

Political and administrative constraints also exist which may hinder development. These include competition for land and water areas, and regulations at Federal, State, territorial, and local levels.

National Aquaculture Development Act

The private sector has provided much of the impetus for the development of the U.S. aquaculture industry. However, the need for a coordinated effort at solving the political, administrative, scientific, and technological problems hindering aquaculture, as well as its importance as a potential food source, spurred passage of the National Aquaculture Act of 1980. This milestone Act states that national policy is to "encourage the development of aquaculture in the United States," and that "the principal responsibility for the development ...must rest with the private sector." The general role of the Government is to provide encouragement and support through programs and services that cannot reasonably be expected from private sources.

To help plot a course for the U.S. aquaculture industry, the Act mandated the establishment and implementation of a national development plan. The detailed two-volume plan was prepared by the Joint Subcommittee on Aquaculture (JSA) of the Federal Coordinating Council on Science, Engineering, and Technology. The JSA was created to increase the overall effectiveness of Federal aquaculture programs by improving coordination and communication among participating agencies.

The JSA has representatives from a broad range of Federal agencies, illustrating the scope of issues and interests involved. Member agencies include: the U.S. Departments of Agriculture, Commerce, Interior, Energy, Health and Human Services, the Environmental Protection Agency, the Corps of Engineers, the Small Business Administration, the Agency for International Development, the Tennessee Valley Authority, the National Science Foundation, and the Farm

Credit Administration. Chairmanship and vice-chairmanship of the subcommittee rotate among representatives of the Departments of Agriculture, Commerce, and Interior.

The National Aquaculture Development Plan (NADP), published in September 1983, provided many recommendations, including the roles of industry, States, the universities, and Federal agencies. The JSA continued as the coordinating body for Federal involvement. Panels on science, technology, and engineering; economics; and education and technical assistance coordinated national and international groups involved in aquaculture, facilitating the exchange of information, and monitoring research and other developments in the industry.

The NADP also called for the development of a National Aquaculture Information System (NAIS) to be compiled and maintained by the National Agricultural Library of USDA. The NAIS will include bibliographic files, translations of foreign scientific papers, the results of surveys and statistics, and selected aquaculture directories.

Studies on the capital requirements for industry development and regulatory impacts were conducted under the plan. In addition, research in such areas as genetics and reproduction, nutrition and diets, environmental requirements, and control of disease and parasites was initiated.

The Future of U.S. Aquaculture

Annual per capita consumption of fishery products has risen almost 2 pounds since 1962. Increasing concerns about health and diet, the growth of fish and shellfish available in the away from home market, and expected population expansion over the next 20 years, suggest that this trend will continue.

In addition, economic conditions will affect the demand for fish and shellfish products. Since 1960, increases in per capita disposable income have contributed to a 25-percent rise in consumption of red meats, poultry, and fish, much of it away from home, where about two-thirds of fish and shellfish sales occur.

While demand is likely to increase, the available wild supply of traditional species will not—at least not without pursuing the trend of recent years of using sophisticated and expensive techniques to find the ever-diminishing wild fish stocks. In many areas of the world, the supply of wild fish has been reduced to the point that legal restraints now limit international fishing.

Canadian officials recently reported at their first National Aquaculture Conference that "...the finite ability of the ocean to produce fish, especially in its polluted state, and the steadily rising costs of hunting the wild schools...makes aquaculture a compelling alternative." Promotion of Canadian aquaculture stems from two 1982 inquiries which found that traditional conservation methods have not halted the depletion of natural stocks through overfishing and pollution. Legal constraints, including issuing restricting licenses, limiting boat size, and restraining technological gear used to hunt or catch fish, have also been used to manage traditional fisheries.

Unlike the traditional ocean fishing industry, aquaculture allows greater control of the quantity of fish and shellfish, enabling production to expand or contract more easily to meet market demand. Further, in species where spawning cycles can be controlled aquaculture provides flexibility in the time of marketing, thus eliminating some of the seasonality of fishery products.

Aquaculture products also may be of better quality. Cultured oysters, for example, while identical in taste to those harvested, have a distinct advantage—they can be free of fouling organisms, making them superior for eating raw.

Further advancements in quality and yields are likely as scientists explore the limits of selective breeding in aquaculture. Drawing a parallel to agriculture, by the 1950's, 70 percent of all cultivated land was planted with improved varieties of crops not in existence 20 years before. This reflected a strong influence of Federal and State aid to experiment stations and crop research.

Aquaculture even has some advantages over agriculture. Fish, for example, are more efficient converters of feed to protein than cattle, hogs, or poultry. The feed-to-food ratio is 1.9:1 for catfish meaning that it takes 1.9 pounds of feed to produce 1 pound of catfish product. The ratio for hogs is 4:1, for cattle, 8:1, and for poultry, 2:1.

Aquaculture projects could also be established in areas not suitable for other food production, such as the warm waste water of hydroelectric plants or in saline or brackish water. A number of companies are experimenting with using cooling water from pulp and paper mills, and steam plants for aquaculture. Catfish, trout, salmon, carp, shellfish, tilapia, and other species have been successfully raised using this water. In addition, geothermal springs have been used for fish farming for several years.

Aquaculture may even provide a supplementary enterprise for existing farmers, with an added bonus in some cases of reducing crop production costs. Several combinations of rotating arable and aquatic crops are now being practiced. Crayfish in Louisiana are raised in rotation with rice crops. Rice is grown and harvested, and then the land is reflooded and "seeded" with crayfish which feed on the rice straw and wastes. The crayfish are harvested the following winter or early spring.

Catfish, too, are sometimes combined with other crops, such as rice, on a rotation program. Nitrogenous waste products resulting during catfish production reduce the need for purchased crop fertilizers.

The environmental benefits of aquaculture don't stop there, though. Using fish, shellfish, or aquatic plants to help remove organic or inorganic pollutants from wastewater and then harvesting them also has shown promise in some areas. Wastewater from municipal, industrial, agricultural, and even aquacultural sources can be high in nitrogen and phosphorous, two of the primary elements in the food chain of plankton. Plankton are small plant and

Aquaculture as a World Food Source

Aquaculture has grown as a food source in many countries, particularly over the past 15 years, and now provides an estimated 10 percent of total world fish consumption.

In 1966, world production was estimated at about 1 million metric tons (mmt). By 1975, the Food and Agricultural Organization of the United Nations (FAO) estimated aquaculture output at more than 6 mmt, compared with 60 mmt harvested wild. By 1979, production was estimated at over 9 mmt.

More than one-third of the cultured products are finfish raised by about a dozen countries in Southeast Asia and the Pacific. Most of this production is various species of carp and tilapia, raised in freshwater ponds, and mullet and milkfish raised in saltwater ponds along coastal areas.

Asia, with a long tradition of aquaculture, accounts for much of the world's production. In 1975, Asia produced 5 mmt of culturally grown

fish and seafood, 83 percent of the total. This included aquatic plants, though, which serve as an important source of food in many Asian countries. More than 1 mmt are produced annually through aquaculture in Japan, China, and Korea; seaweed is also grown extensively in tropical waters around Singapore, the Philippines, and elsewhere.

Japan is also an important producer. Freshwater cultured fish include trout, eel, carp, and ayu, a species native to Japan. Japanese saltwater culture production reached 990,000 tons in 1980, with about 512,000 tons attributable to seaweeds. Shellfish production totaled 310,000 tons and fish, 170,000 tons in 1980.

Other important sources include Ecuador, the largest producer of culturally grown shrimp; Taiwan; Israel; and the Philippines. Estimates indicate culturing accounted for between 8 and 40 percent of total fish production in these countries.

animal organisms that serve as feed for fish. In some areas walleye, northern pike, or muskellunge, as well as bait minnows, have been successfully produced in wastewater.

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Planting for the Future

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Euphorbia, rapeseed, jojoba, meadowfoam, crambe, and guayule—unfamiliar now, but someday these plants may join soybeans and other crops as an important part of our lives. Maybe they'll fuel our cars or improve our health and appearance. They might be used to clean floors, wax cars, or lubricate jet engines. They may even find their way into the food supply as low-calorie salad oils.

Renewable energy sources, liquid gold, and desert crops—many real and wishful attributes have been given these unique oil crops. Some already are grown commercially in the United States and elsewhere, while others grow wild, unharvested for profitable use.

To a growing number of plant researchers, industry-watchers, and investors, these crops could be the next soybean of U.S. agriculture. Many people are taking a first or closer look at these mysterious crops, the new horizons they bring, and their exciting potential to change the way we live in the 21st century.

Guayule

Guayule (pronounced why-ōō-lee) is a flowering shrub that grows wild in southwest Texas and northern Mexico. It produces rubber in amounts of 10 to 20 percent of the plant's dry weight. This rubber is chemically and physically identical to Asian rubber which comprises 97 percent of the world's natural supply.

Spanish conquerors of Mexico discovered the plant in the 1500's. As late as 1910, guayule was the source of 50 percent of all the rubber used by the United States, and 10 percent used in the world. Following World War II, it was displaced by Asian rubber, which again became accessible, and by synthetics developed from low-cost petroleum. During the 1950's, a small effort was made to bring guayule back and establish a seed reserve. But it was not until the 1974 "Energy Crisis" that guayule regained attention as a possible alternative to synthetic rubber.

Interest continues to grow in response to both the high cost and vulnerability of imported rubber and crude petroleum supplies. Currently over half of the crude oil and nearly all of the natural rubber used by the United States is imported, much of it from countries subject to political instability. In addition, Asian rubber trees face threats from South American leaf blight, which can wipe out an entire plantation.

Guayule could be grown on up to 5 million desert acres in the American Southwest, filling all U.S. natural rubber needs. In 1978, Congress passed the Native Latex Act, establishing a national policy to provide for the development and demonstration of ways of growing guayule. The Act is similar to legislation passed to promote gasohol development and addresses a national need to reduce dependency on foreign energy supplies.

The Government began a campaign in 1981 to end this dependency by bartering for strategic materials and promoting commercialization of key native sources of energy, including guayule. Experts say guayule is ideally suited for surgical supplies, aircraft tires, and radial tires and could reduce the use of petroleum-based synthetic rubber.

Euphorbia

Euphorbia could change the way we fuel our cars. Called the "gasoline plant," it contains latex, which has a molecular structure similar to crude oil. The plant grows wild in northern California and is under cultivation to adapt to the Southwest. Wild euphorbia has been estimated to produce 2 to 10 barrels of crude hydrocarbon per acre per year. With genetic improvement, production could be raised to as much as 50 barrels per acre of a low-sulphur product that might serve as raw product for refineries.

While euphorbia offers the United States the potential to grow its own oil, don't look for your local station to start selling euphorbia-based gasoline soon. Petroleum prices would have to rise significantly for euphorbia derivatives to be used as additives in gasoline, but like

gasohol it is an alternate source when needed. Euphorbia could help reduce dependency on foreign oil, it has no environmental hazards, and it can be grown on land currently useless for other forage or crops.

Crambe and Rapeseed

Crambe, a member of the mustard family, received considerable attention in the 1960's when USDA and some universities conducted research on this new oilseed. Cultivation was encouraged as a spring crop suitable to the wheat-growing areas of the Pacific Northwest and upper Midwest and as a winter crop in Texas.

Like soybeans, crambe yields oil and meal when crushed. Early researchers were optimistic about the possibilities for crambe to satisfy industrial demands for lubricating oils and provide meal for animal feed. While crambe oil lived up to expectations, the meal contains toxic substances harmful to animals.

Crambe oil is much like that derived from rapeseed, another oil crop. Both are desirable for their high smoke point lubricating properties, which means that under heat they won't break down quickly or catch fire. They are also useful for lubricating surfaces exposed to water, such as marine vessels.

Until 1981, some rapeseed was grown commercially in the United States, primarily in North Dakota. According to the 1978 Census of Agriculture, a record 50,000 acres were grown in that year.

Canada is currently the world's leading producer of rapeseed, producing nearly 2.1 million tons in 1982. This was down from the record 3.4 million tons harvested in 1979. Canada exported more than 50 percent of its crop in 1982, making it the world's leading rapeseed exporter. Japan is Canada's biggest customer—annually taking 60 to 75 percent of its exports. Canada also recently signed a long-term agreement to supply rapeseed oil to Algeria.

The United States imported about 8,000 tons of denatured rapeseed oil for industrial purposes in 1982. Like crambe,

toxins are present in rapeseed oil and meal which make them unsuitable for food and feed use. Canada, however, has successfully developed varieties of rapeseed, called "double-low" and marketed under the name Canola, that don't have a toxicity problem. This oil is now used in edible products in Canada.

The future of rapeseed as a U.S.-grown crop may well depend on the potential for industrial uses and the recent approval by the Food and Drug Administration (FDA) for importing Canadian rapeseed oil for food use into the United States. There is an important difference, however, between industrial and food rapeseed oils. It takes two different varieties of rapeseed to satisfy these demands, and they are not substitutes for each other. Industrial use of rapeseed oil requires a high erucic acid content, the very quality that makes the oil harmful as a food product. Whether it is grown, and the type of rapeseed produced in the United States in the 21st century, will likely depend on the greater source of final demand—the food or chemical industries.

Meadowfoam

Meadowfoam is a short variety oilseed crop planted in the fall. It is named for its white flowers which give a field in bloom the appearance of being covered with fluffy white foam. Because it is especially adaptable to soggy, poorly drained soils, meadowfoam is under development in the Pacific Northwest, primarily in the Willamette Valley of Oregon and in northern California, where machinery used for an alternate crop—annual ryegrass seed—is available. Farmers in this region are also prohibited from burning the stubble left from the previous year's grass crop, a practice that reduced the time it took to till and prepare the soil for spring planting. Meadowfoam may have an advantage since it doesn't leave stubble; consequently costs for extra tillage are reduced significantly. Meadowfoam can be planted in November and harvested in late May.



Stem cuttings from high-yielding jojoba plants are cultivated in this environmentally controlled propagation facility in Phoenix, Arizona. Photograph © 1983 Kelly Dwyer—Jojoba Commodities Group.

As far back as 1969, USDA described meadowfoam as a promising new source of industrial oil. Research has shown that it is possible to obtain per acre yields of 2,500 to 3,000 pounds of seeds that contain 20-30 percent oil. Oregon State University's Agricultural Experiment Station has also developed improved varieties of meadowfoam, contributing to its development as a domestic crop.

The unique composition of meadowfoam oil makes it potentially useful for industrial products. The oil has properties similar to those of the promising jojoba plant.

Jojoba

Jojoba (pronounced ho-ho'-ba) is an oilseed that grows wild in the Sonoran Desert region of Arizona and Mexico. Some jojoba plants are believed to be 200 years old, and the crop has been around even longer. Early Spanish explorers found Indians using jojoba, and written references to the plant date back to 1701. In 1789, a Jesuit historian in Mexico, first published an extensive report on jojoba.

But it was not until 1933 that jojoba oil was "rediscovered" by workers at the University of Arizona and the Boyce Thompson Arboretum.

Jojoba is a perennial evergreen shrub, which accounts for the long life of some of the plants. Jojoba produces a seed that looks like a small green olive and contains as much as 60 percent, by weight, of a light yellow, odorless, liquid wax, nearly identical to sperm whale oil, a key industrial lubricant. Prior to the ban on imports initiated when the sperm whale was designated an endangered species in 1971, sperm oil was a very important component of lubricants because of its ability to cling to "wet" metals. Its continuous lubricating characteristic made sperm oil valuable in automatic transmission fluids, cold rolling of steel, and for lubricating precision instruments. Synthetic lubricants have been developed to replace sperm oil, but they are less satisfactory and more costly.

If jojoba can be adapted to large-scale commercial production, it could be an excellent substitute for sperm oil. But jojoba

has some very unique, and inhibiting characteristics that pose problems for potential producers. For instance, jojoba is a dioecious plant; that is, some produce male flowers, and others, female. Only the female flowers produce the valued seed. Researchers, however, haven't figured out how to tell before the plants blossom which will be male or female. There are no petals, nectaries, or scent glands that provide clues to the sex of the plant or to attract pollinating insects.

This presents a second problem, pollinating the plants. Experiments are being conducted with wind pollination—collecting pollen from male plants and blowing it over a field of female plants.

A third problem with commercial production is the slow growth of the jojoba plant into a mature producing shrub. It takes about 5 years to produce mature seed for harvest. This makes many potential investors and producers reluctant to commit resources to jojoba. The payoff may be great, but the risks and initial costs are equally high.

The claims for jojoba are many and varied, and unfortunately, most remain unsubstantiated by experiments and tests. It has been suggested, for example, that jojoba oil can prevent baldness and

stimulate hair growth. Others promote it as a “natural” product for use as salad or cooking oil since it is polyunsaturated and purportedly calorie-free. Still others claim that as an engine oil additive, jojoba can increase gasoline mileage by 3 to 5 miles a gallon.

For now, many of these claims appear to be, at best, wishful thinking. Jojoba does have certain chemical properties that make it particularly attractive for industrial uses and in health care and cosmetic products. It has already found its way into shampoos and makeup; jojoba oil is found in over 300 different brand names of cosmetics in the United States.

For potential users, the big problem with jojoba is its price. The liquid wax has been priced from \$50 to more than \$100 per gallon in the past few years. That's equivalent to \$7 to \$14 per pound, compared to rapeseed oil which sells for about 54 cents a pound. If some of the major obstacles to commercial production can be overcome, and if production expands, the price of jojoba will fall, and the quantity demanded should increase. Until then, jojoba faces a long road before it finds its way into more than a limited number of products.

2000 and Beyond

Years of determined effort by pioneering scientists and forward-looking businessmen, as well as supporting economic and political environments, are usually required to successfully develop a new crop. In addition, there must be extensive coordination in developing and advancing different stages of production and marketing. High-quality seed must be available to trained producers at a time when a market exists for the end use of the product. Furthermore, transportation and processing facilities must be available.

The time needed for these processes may be considerable. Soybeans, for example, required more than 100 years for full production and marketing development in the United States, even though they had been “domesticated” several thousand years earlier. Meadowfoam, in contrast, was domesticated only about 30 years ago.

It is unlikely that any of these “new” oil crops will provide all the answers. No single crop can solve the energy crisis, cure ill-health, change our lifestyle, or satisfy our food needs. But given time, each of these crops could eventually find a niche in our system of farm-raised products.

Planting for the Future

| Crop | Where grown: | Grown for: | Possible uses: | Toxicity: | Currently grown |
|------------|---|-------------------|--|-------------------------------|-----------------|
| Euphorbia | Northern California | Natural crude oil | Refineries, gasoline | — | Experimentally |
| Rapeseed | N. Dakota, Pacific Northwest | Oil | Oil—industrial lubricant, food oil | Some varieties have toxic oil | No |
| | | Meal | Meal—feed additive | Meal has toxicity | |
| Jojoba | Arizona, Sonora Desert | Oil | Lubricant, cosmetics, hard waxes | Unknown | Yes |
| | | Meal | Meal—feed additive | Unknown | |
| Meadowfoam | Willamette Valley, Oregon; No. California | Oil | Industrial lubricant | — | Experimentally |
| Crambe | Pacific Northwest | Oil | Industrial lubricant | — | No |
| | | Meal | Meal—feed additive | Yes | |
| Guayule | Southwest Texas | Rubber | Surgical supplies, aircraft/radial tires | — | Experimentally |

— = Not applicable since not used for food or feed.

Food Irradiation: An Update

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This article highlights recent regulatory and commercial activity on food irradiation internationally and in the United States. An article that appeared in the February 1983 NATIONAL FOOD REVIEW, NFR-20, discussed the costs and benefits of irradiation, the factors affecting its economic feasibility, and possible obstacles to widespread commercial use.

Irradiation's role in the U.S. food system may soon be expanding. The Environmental Protection Agency's (EPA) recent decision to suspend the use of ethylene dibromide (EDB) as a fumigant on stored grains, milling machinery, citrus fruits, and papayas has focused attention on finding alternative, nonchemical substitutes.

Food irradiation—the use of ionizing radiation to kill insects or destroy microorganisms that cause spoilage—just might be that nonchemical alternative. The process, first patented for food preservation in France in 1930, is currently the subject of a proposed new rule by the Food and Drug Administration (FDA) and two recent bills introduced in Congress.

Today, in the United States, commercial irradiation is legal for only a few foods. It has not been widely pursued because of several factors: the availability of alternative preservatives and fumigants, regulatory barriers, questions about its practicality and cost advantage, and concern over consumer acceptance. The only irradiated foods available to U.S. consumers are spices and powdered vegetable seasonings, approved by FDA in July 1983. Internationally, 21 countries allow one or more of 31 foods to be irradiated (table 1).

FDA's proposed rule would allow processors to irradiate a wider range of foods at low dosages and would raise the level of irradiation permissible for spices. The proposed rule would also establish additional requirements for persons irradiating food and change the existing labeling requirement. Bills introduced in both the House and Senate seek to advance the

Table 1. International Clearances for Food Irradiation

| | |
|---------------|--|
| Argentina | Potatoes |
| Bangladesh | Potatoes, onions, wheat and flour, spices, chicken, fish and fish products, frozen shrimp, frogs' legs, rice and rice products, pulses, papayas, mangoes |
| Belgium | Potatoes, onions, garlic, shallots, spices, strawberries, paprika |
| Canada | Potatoes, onions, wheat and flour |
| Chile | Potatoes, onions, wheat and flour, spices, chicken, fish and fish products, rice and rice products, cocoa beans, dates, pulses, papayas, mangoes, strawberries |
| Denmark | Potatoes |
| France | Potatoes, onions, garlic, shallots, spices |
| Hungary | Onions, spices |
| Israel | Potatoes, onions, chicken |
| Italy | Potatoes, onions, garlic |
| Japan | Potatoes |
| Netherlands | Potatoes, onions, spices, mushrooms, chicken, fish and fish products, frozen shrimp, frogs' legs, rice and rice products, rye bread, cocoa beans, strawberries, endive, asparagus, battermix, egg powder, blood proteins |
| Norway | Spices |
| Philippines | Potatoes |
| Poland | Potatoes, onions |
| South Africa | Potatoes, onions, garlic, chicken, papayas, mangoes, strawberries, mango achar, bananas, litchis |
| Spain | Potatoes, onions |
| Thailand | Onions |
| Uruguay | Potatoes |
| United States | Potatoes, wheat and flour, spices |
| USSR | Potatoes, onions, dry food concentrates, grain, dried fruits |

Source: Food Irradiation Newsletter (see references)
p. 10, updated April 1984.

use of irradiation by providing Federal assistance for the continued development and commercialization of the process. The outcome of these efforts will have an impact on how extensively and under what conditions irradiation will be used as a food preservation technique in future years.

Effects of Irradiation

Irradiation preserves food by using high energy gamma rays, X-rays, or electrons to kill microorganisms and insects that can contaminate foods. The ionizing radiation from these three sources kills the pest, in part, by damaging its chromosomes and genes. Gamma irradiation refers to the use of gamma rays emitted from the radioactive isotopes cobalt-60 and cesium-137. Electrons and X-rays are produced by an electron beam accelerator powered by electricity. Electrons have less penetrating ability than gamma rays and X-rays, but they may be more economical for irradiating large amounts of small food particles. The energy levels of all three sources to be used will not make the food radioactive.

The effects of irradiation applied to a product depend on the absorbed dose, usually measured in kilorads. At low doses of 5 to 100 kilorads, insects that infest grain and fresh fruits and vegetables are destroyed or rendered unable to reproduce. In addition, this low dose range causes chemical and physiological changes that delay ripening of some fruits or sprouting in root crops, such as potatoes and onions. A low dose of irradiation can also destroy food-borne parasites, including trichinae, the organisms that cause the disease trichinosis in swine and humans.

Doses of 100 to 1,000 kilorads reduce the number of microorganisms, including spores, that cause spoilage, thereby extending the shelf life of treated foods. This dose range also inhibits postharvest fungi development in fruits and reduces microorganisms that pose public health threats, such as salmonella.

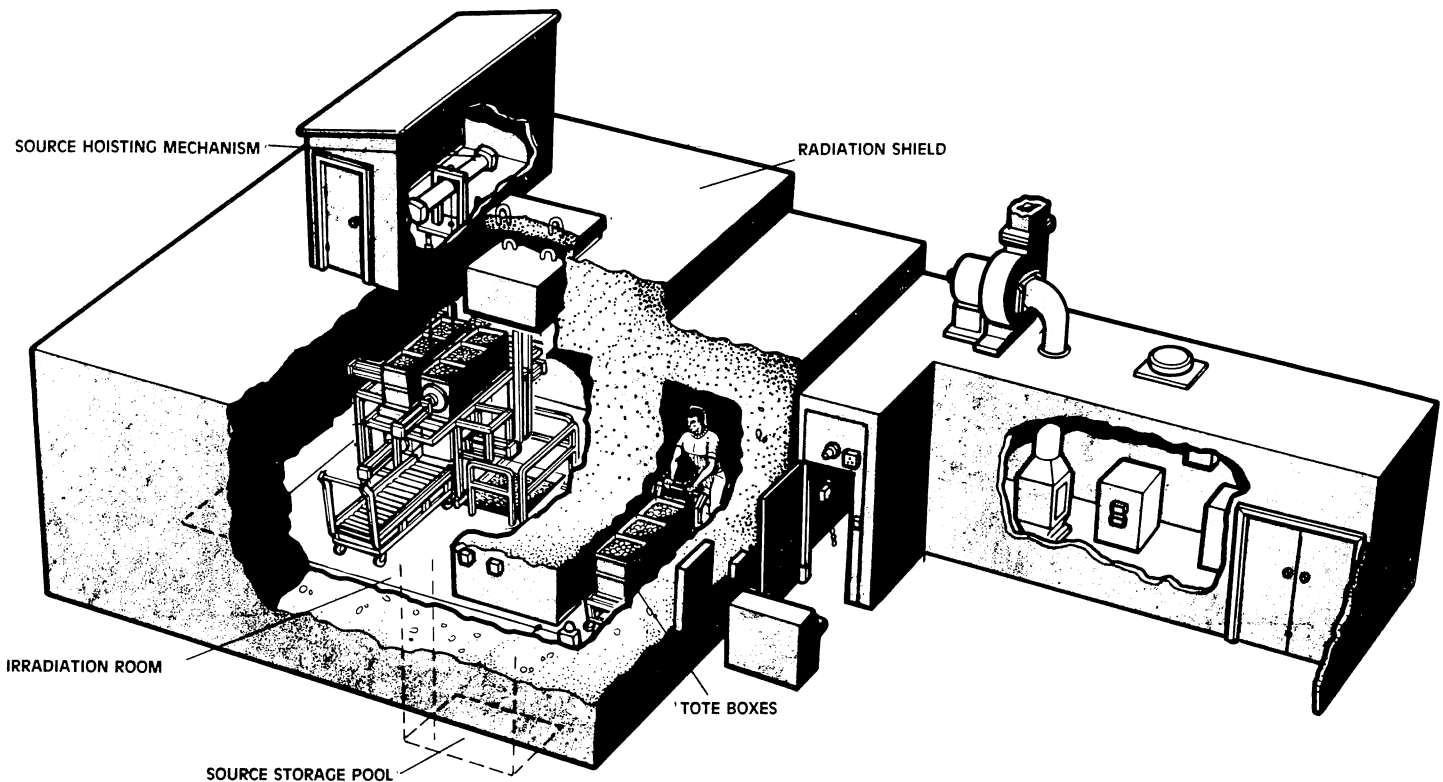


Diagram of an irradiator in use in South Africa for tropical fruits and strawberries. Courtesy of Atomic Energy of Canada, Ltd., Ottawa.

Doses of irradiation from 2,000 to 7,500 kilorads, in combination with heating, sterilize a food so that it can be stored in sealed containers at room temperature for many years. Heating inactivates enzymes in the food which would cause the food to decompose during storage. Unlike sterilization of food by cooking, irradiation raises the temperature of the food only slightly and minimizes nutrient loss and changes in texture, color, and flavor. However, as in overcooking, too high a dose can soften food, affect its taste, and decrease its nutritional value. Also, certain foods, such as dairy products, are more sensitive to the irradiation process and develop an off flavor.

Current Regulatory Status

The 1958 Food Additive Amendment to the Federal Food, Drug, and Cosmetic Act identified "any source of radiation" used in processing or packaging food as a food additive. This amendment requires processors to comply with FDA's regulations prescribing safe use of radiation on foods or to submit a food additive petition with data supporting an amendment to these regulations. If FDA determines that an additive is safe for use in food, it will establish conditions for safe use, including in which foods and at what levels,

as well as any labeling or packaging requirements necessary to assure safety. FDA will not approve the use of irradiation or any other food additive if its use would deceive consumers or result in adulteration of the food or misleading labeling.

Currently, irradiation can be used on wheat, wheat flour, potatoes, and spices. For wheat and wheat flour, doses between 20 and 50 kilorads to control insect infestation have been legal since 1963, and for potatoes, doses of 5 to 15 kilorads to inhibit sprouting were approved a year later. Neither of these applications has ever been used because of the availability of less expensive and easier to use chemical alternatives. In July 1983, FDA approved gamma radiation to control microbial contamination in dried spices and dehydrated vegetable seasonings (onion and garlic powders) at doses up to 1,000 kilorads. Only a very small portion of U.S. spices are presently irradiated; the remainder are treated primarily with ethylene oxide.

Under existing regulations, any retail irradiated food must be labeled "treated with ionizing radiation" or "treated with gamma radiation." Wholesale packages and invoices or bills of lading for bulk shipments must add the phrase "—do not irradiate again."

FDA's Proposed Regulations

In the February 14, 1984 *Federal Register*, FDA issued a proposed rule that would allow the use of irradiation to delay ripening of fresh fruits and vegetables and to kill insects that infest food. Doses could not exceed 100 kilorads. FDA is also proposing to raise the maximum dosage for dried spices and vegetable seasonings to 3,000 kilorads. This 2,000-kilorad increase for spices would kill all microbial and insect contaminants. FDA is now reviewing public comments before issuing a final rule.

The terms of this proposed rule came out of a 1980 report of FDA's Bureau of Foods' Irradiated Food Committee (BFIFC). One of the assignments of the BFIFC was to assess the safety of the radiolytic products formed when irradiation breaks certain chemical bonds and molecules reattach differently. Similar reactions occur during cooking, and the BFIFC found that 90 percent of the radiolytic products identified are natural components of food. After reviewing previous radiochemistry studies, the BFIFC concluded that irradiation at 100 kilorads or less yields a concentration of total radiolytic products in food of 30 parts per million—a level that is difficult to detect using current analytical methods. The

concentration of unique radiolytic products (compounds not found in the food before irradiation) would be on the order of 3 parts per million. The BFIFC concluded that this low level of unique radiolytic products means that food irradiated at 100 kilorads or less is safe for human consumption.

The BFIFC made a separate recommendation concerning foods that comprise less than 0.01 percent of the daily diet, such as spices. The Committee concluded that this category of foods could be safely irradiated at doses up to 5,000 kilorads because of the extremely small amount eaten per person per day. Also, scientists have found that the quantity of radiolytic products produced by irradiation is smaller in foods containing less water. Therefore, irradiation of spices, which contain little or no water, would yield a smaller quantity of radiolytic products than would moist foods.

International Status

As of April 1984, 21 countries allowed irradiation to be used commercially on certain foods; most commonly for disinfecting fresh fruits, decontaminating spices, and inhibiting sprouting of potatoes, onions, garlic, and ginger. In addition, several countries have issued restricted clearances for experimental batches and test marketing of irradiated foods.

In 1980, the Joint Expert Committee on the Wholesomeness of Irradiated Food, sponsored by the Food and Agriculture Organization of the United Nations, the International Atomic Energy Agency, and the World Health Organization, concluded that "the irradiation of any food commodity up to an overall average dose of 10 kGy (1,000 kilorads) presents no toxicological hazard" and "... introduces no special nutritional or microbiological problems." In July 1983, this level was approved for food use by the Codex Alimentarius Commission, an international group that develops glo-

Retail labeling of irradiated foods is an important issue to both processors and consumers. Processors argue that labeling is inappropriate because irradiation is a process, not an additive. Manufacturers fear that if consumers read the currently required statements, they will shun the food for fear that it is radioactive. Consumer advocates, on the other hand, have commented that consumers have the right to know if a food has been irradiated.

In the proposed rule, FDA reversed its earlier position on labeling stating: "The agency now believes that there is no need for a special label on irradiated foods because this proposal would limit the conditions of use of irradiation to those that have already been shown to be safe." The proposal goes on to say, however, that FDA will continue to review new information on the labeling issue and welcomes comments on this area. FDA de-

cided to retain the labeling requirement, "treated with ionizing radiation—do not irradiate again," for nonretail containers of irradiated foods and for the invoice or bill of lading used in shipping bulk foods.

FDA also proposed a few other regulations for firms irradiating food. Firms would be required to have "a qualified person with expert knowledge of radiation processing" develop a scheduled process specifying the dose range needed to achieve the intended effect. In addition, FDA has reserved the right to inspect the processor's records pertaining to the irradiated foods. These records will include the food treated, the lot number, the scheduled process, information relating to compliance with the scheduled process, distribution of the irradiated food product, and date of irradiation. These records must be available for FDA inspection for 1 year beyond the expected shelf life of the irradiated food.

Pending Irradiation Legislation

Food irradiation is also receiving attention from Congress. Last fall and winter, legislation was introduced in the House and Senate to promote irradiation as a postharvest treatment of raw agricultural commodities by reclassifying it under a different set of existing regulations. As written, the bills are unclear as to whether FDA or EPA would be responsible for regulating food irradiation.

Because of this confusion, Representative Sid Morrison (R-Wash.) drafted a replacement bill that would recognize irradiation as a process or treatment, but keep it under FDA's food additive regulations. The replacement bill, H.R. 5605, was introduced into the House on May 7, with 21 cosponsors. An identical bill was introduced into the Senate by Senator Slade Gorton (R-Wash.) 2 days later.

Unlike the earlier bill, H.R. 5605 would permit irradiation of processed foods rather than just raw commodities. The bill would also ensure uniform regulation of the process to permit national marketing of irradiated foods. No State or local governments could establish irradiation

bal food standards. The Codex Committee on Food Labeling has stated that it will recommend to the Commission in July 1985 that irradiated prepackaged foods be labeled "treated by ionizing energy."

Irradiation use varies by country. The Japanese have operated a commercial plant since 1973 that irradiates 10,000 to 20,000 tons of potatoes per year. The Netherlands has approved irradiation for many foods including mushrooms, onions, potatoes, and chicken. South Africa irradiates chicken and several varieties of fruits and vegetables. During the last half of 1983, over 1,600 tons of commodities were irradiated there for commercial sale. Irradiated food in the Netherlands carries a small symbol indicating that it has been irradiated. Irradiated products in South Africa are sold under the RADURA label using the same symbol. Small quantities of irradiated food are also sold in Belgium and Hungary, and other countries are test marketing irradiated vegetables and spices.

procedures or labeling requirements different from Federal ones. But, State or local governments could petition FDA to adopt new regulations for irradiating foods. The bill also provides for leasing one of the radioactive isotopes used in food irradiators from the Government.

The last part of H.R. 5605 proposes a joint operating commission within USDA to coordinate and manage all Federal research and development relating to food irradiation. The Commission would also coordinate educational activities, encourage interest and investment by private firms in food irradiation, and when appropriate, petition FDA for expanded uses of radiation on more foods or at higher doses. The Commission would have seven representatives from various Government agencies and one individual representing the general public.

U.S. Irradiation Industry Today

In addition to food preservation, irradiation has several industrial applications. One of the major uses is to sterilize medical instruments and supplies. Irradiation is also used to treat the insulation on wire and cable, cross-link plastic food wrap, and vulcanize sheet rubber. Another proposed use is to disinfect sewage sludge. A 1980-81 survey listed 142 large-scale gamma irradiators in the United States licensed by the Nuclear Regulatory Commission or State agencies. This list includes both research and commercial irradiators.

Commercial food uses of irradiation in the United States today are confined to reducing microbial contamination of spices and occasionally treating fresh produce for shipment overseas. Radiation Technology Inc., a contract sterilizer in Rockaway, N. J., reports irradiating between 5 and 6 tons of spices a week, most of which are used in processed foods or spice and flavoring blends. Cleaner spices extend the shelf life of the meat products in which they are used. The company has also reached an agree-

ment to build and jointly operate an irradiator in Hawaii to disinfest papayas, mangoes, and other products.

A handful of other sterilizers have varying degrees of interest in irradiating food. Some are experimenting with different foods for commodity associations, food processors, and in-house purposes. Isomedix, Inc., another New Jersey sterilizer, is also irradiating poultry for a Canadian study on the effectiveness of irradiation in killing salmonella microorganisms in poultry.

USDA's Agricultural Research Service has been working on irradiation-related projects for 25 years. USDA scientists in Florida and Washington are investigating the use of irradiation for insect control and quarantine treatments of fruits. In 1980, USDA's Eastern Regional Research Center (ERRC) in Philadelphia, Pa., took over work on irradiation-sterilized meats which the Department of the Army had been conducting since 1948. USDA has recently completed a lengthy and comprehensive study on the wholesomeness of irradiation-sterilized chicken. The data have been turned over to FDA for review and will be available for any person interested in submitting a petition to FDA. The ERRC is also studying irradiation as an alternative to nitrate and nitrite and the effectiveness of low doses in extending shelf life. The Department of Energy (DOE) also sponsors research on gamma radiation's industrial uses. DOE's most recent work has been on using low-dose radiation to produce trichinae-free pork.

While the United States has a long history of research on irradiation's applications in food preservation, other countries have been more progressive in actually using the process (see insert). Currently, most irradiated foods are consumed within the countries where they are treated. However, a technology that retards food spoilage has implications for expanding market areas or allowing the use of slower, less expensive transportation. Irradiation is especially appealing to developing countries where limited trans-

portation and storage networks make spoilage a serious problem. For other countries, the benefits of irradiation may be in providing an alternative to chemical fumigants like EDB and preservatives like sodium nitrate and nitrite. Other benefits may come in public health gains from less exposure to salmonellae and trichinosis.

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Changes Ahead for Eating Out

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Americans have a growing appetite for eating out. This year we'll spend nearly \$170 billion to keep from slaving over a hot stove. That bill represents more than 41 cents out of each dollar spent for food, up from 33 cents as recently as 1970, and well above the 27 cents paid to eat away from home in 1960.

Changes in the national living pattern are prompting the move toward eating out or taking prepared food home. Those who keep tabs on social and economic trends point to these factors: a growing number of women, married and single, in the work force; more families living on two incomes; the increasing importance of convenience in eating out; more people in that age group—25 to 44—inclined to eat out often; and the impact of advertising and promotion by large foodservice chains.

However, with continuing shifts to smaller families with more money to spend and a society dominated by adults with more sophisticated tastes, the foodservice industry may strive to improve the variety, quality, and nutrition of its products. Already concern about health and fitness has encouraged consumer preferences for foods perceived as fresh, less highly processed, and "light"—lower in calories, fat, cholesterol, added sugars, sodium, and certain additives.

Changing Mix of Foods

The foodservice industry has undergone some phenomenal changes over the past 20 years. Fast food outlets, for example, are growing at the expense of independent diners—those establishments providing waiter or waitress service at counters and booths. Diners now comprise less than 10 percent of all eating places, compared to 23 percent only 15 years ago.

The number of fast food outlets has tripled since 1963, from nearly 40,000 to more than 122,000 in 1982. With their increase came some new dimensions in eating out—limited menu selections, standardized operations, rapid service, moderate prices, and a marked uniformity and consistency of quality. Indeed, the

service and products of the larger chains are expected to be the same in Manchester, Conn., as in Monterey, Calif.

As the places where we're eating changed, so has the selection of foods. Increasingly, meals away from home consist of the more limited menu offerings of such places as fast food outlets, ethnic, theme, or specialty restaurants. But national surveys of the foodservice industry conducted in 1966 and 1979 found that the "varied American plate meal"—characterized by a meat, poultry, or fish entree, a vegetable or grain, usually potato or rice, and a serving of salad or fruit—is still the dominant menu specialty away from home, particularly in prisons, schools, hospitals, and similar places that comprise the noncommercial sector of the away from home market (*see insert*).

Noncommercial eating places accounted for 25 percent of the retail value of all food consumed away from home in

1979. Varied American plate meals comprised 96 percent of the food and beverage sales in this sector, compared to 40 percent in the commercial market.

Among what analysts of the foodservice industry call "separate eating places"—restaurants, fast food places, and other outlets that sell food for profit and are not part of another business—only 31 percent had varied American plate meals in 1979, compared to 40 percent in 1966. This decrease was largely due to the decline of one particular type of separate eating place—the local diner. The share of sales attributed to separate eating places serving varied plate meals fell from 43 percent in 1966 to 34 percent in 1979.

Twenty-five percent of separate eating places specified hamburgers, hot dogs, and sandwiches as house specialties in 1979. Others included ethnic foods, 14 percent; ice cream, doughnuts, or pas-

The Food Away from Home Market

There are more than half a million places to eat out in this country, ranging from the hot dog counter at the ball park to the school cafeteria.

The away from home market is composed of commercial foodservice establishments—those outlets operating primarily for profit—and noncommercial outlets, including university and military dining rooms and similar places.

About 85 percent of the sales of commercial foodservice establishments are in separate eating places, defined as those outlets that derive revenue mainly from sales of meals and snacks. The remaining sales in this sector are in

outlets that are part of a larger facility whose foodservice sales are less than other revenues. This may include a bowling alley snack bar or department store coffee shop.

Although the typical noncommercial outlet serves food to more people than commercial eating places, they account for only 30 percent of the total retail value of food away from home. A closer look shows that and child care centers are responsible for about 19 percent; hospitals and care facilities, 28 percent; plants and office buildings, 15 percent; vending, 10 percent; military services, 6 percent; transportation, 4 percent; associations, 3 percent; correctional facilities, 2 percent; and other institutions, 2 percent.

Table 1. The Changing Market Means Older Consumers, Smaller Households, and a Tilt Toward the South and West

| | 1970 | 1980 | 1990 ¹ | 2000 ¹ |
|-----------------------|-------|-------|-------------------|-------------------|
| Millions | | | | |
| Total population | 205.1 | 227.7 | 252.0 | 267.5 |
| Percent of total | | | | |
| Population, by age | | | | |
| Under 25 | 45.9 | 41.4 | 36.0 | 34.3 |
| Under 10 | 18.3 | 14.6 | 15.2 | 13.6 |
| 10-24 | 27.7 | 26.8 | 20.9 | 20.7 |
| 25-44 | 23.6 | 27.7 | 32.5 | 29.9 |
| 45-64 | 20.6 | 19.6 | 18.6 | 22.8 |
| 65 and over | 9.9 | 11.3 | 12.8 | 13.1 |
| Population, by region | | | | |
| Northeast | 22.3 | 21.7 | 19.4 | 17.3 |
| North Central | 26.5 | 26.0 | 24.2 | 22.3 |
| South | 32.5 | 33.3 | 35.1 | 37.0 |
| West | 18.7 | 19.1 | 21.2 | 23.4 |
| Millions | | | | |
| Total households | 63.3 | 82.4 | 95.2 | NA |
| Percent of total | | | | |
| Persons per household | | | | |
| 1 | 17.0 | 22.7 | 25.2 | NA |
| 2 | 28.8 | 31.4 | 31.6 | NA |
| 3 | 17.3 | 17.5 | 17.1 | NA |
| 4 and over | 36.9 | 28.5 | 26.1 | NA |

NA = Not available.

¹Projections

Source: U.S. Census

tries, 7 percent; pizza, 7 percent; steaks, chops, or roast beef, 6 percent; seafood, 5 percent; and chicken, 4 percent.

The 1980's—Battle for the Consumer Food Dollar

Eating place sales rose 7 percent in 1983, after adjusting for inflation. This growth rate was matched or surpassed in only 3 of the past 25 years. In 1963, real sales rose 7.5 percent; in 1964, 9.7 percent; and in 1967, 7.1 percent. Eating places continue to outperform grocery stores whose sales, after adjusting for inflation, rose 4 percent in 1983.

As consumer spending for food away from home, particularly in fast food outlets, continues to grow, so does the competition. Convenience stores, tradi-

tional restaurants, and even supermarkets (*see insert*) are vying for a share of the take-out prepared foods market. In addition, food marketers are experimenting with new formats, merchandising strategies, and improved food products and services to satisfy the needs and wants of an older, better educated, more diverse, and demanding population.

The fast food industry has moved in several new directions to build its market share. For example, it is starting to place outlets in locations not previously served, such as schools, military bases, central city areas, and international markets. In addition, menus are being enlarged to include such items as salad bars, soups, baked potatoes, gourmet burgers, and whole grain buns. Many of these foods

have been added in response to greater numbers of health and diet-conscious individuals. Many fast food outlets have upgraded their decor to attract more business. To more fully utilize existing equipment and increase unit sales, they are also introducing breakfast and dinner specialties, extending operating hours, and establishing a niche in the catering business.

Many full-service restaurants are experimenting with lighter dishes and emphasizing freshness, quality, regional cooking, and seasonality to increase customer traffic. Compared to fast food places, they enjoy greater flexibility to adapt their menus and preparation methods quickly to meet changing consumer preferences. Some full-service establishments are launching gourmet take-out foods to boost unit sales. For the customer, carryout cuts down waiting time and eliminates the 12- to 15-percent tip. For the restaurateur, it not only builds sales, but expands the customer base.

Looking Ahead

Changes in the variety of foods we eat, the time spent in preparing meals, and the amount of service we buy depend on the alternatives available to us and the amount of income we have. The fast food industry has developed because the necessary technology was available and because our highly mobile society, with a large number of adults working, could afford such a service.

Projections from the U.S. Census suggest that significant changes likely will occur by 1990 that should favor continued increases in eating out (table 1). The proportion of the total U.S. population in the Northeast and North Central regions, for example, is expected to fall from 47.7 percent in 1980 to 43.6 percent in 1990 and 39.6 percent by 2000. This means almost 6 of every 10 Americans could be living in the South and West by the end of this century. About one in four Americans will live in one of the three growth States of the South and West—California, Texas, and Florida.

These projected regional shifts mean greater opportunities for foodservice growth and increases in productivity in the South and West. This could also influence national food purchase and consumption patterns. Meanwhile, marketing opportunities should continue to be found in many areas of the Northeast and Midwest since population density will remain relatively high despite slower growth or even moderate declines in population.

Nationwide, population growth of about 0.9 percent a year will spur competition for the consumers' food dollar among all contenders in the food system.

Changes in two additional factors also will impact on food expenditures away from home. First, the percent of total

population between 25 and 44 years old is expected to increase 4 to 5 percentage points by 1990. Additionally, it is estimated that one-person households will rise from 23 percent of the total population in 1980 to 25 percent by 1990. Prospects for the food away from home industry should be enhanced since people in both these categories tend to eat out more frequently than other age and household size groups.

Changes in income are another important influence on away from home eating. Studies have found that a 10-percent increase in consumers' income results in a 5.5- to 11.6-percent rise in sales of meals and snacks away from home, assuming there are no changes in other factors. To

estimate the impact of changes in income in the next decade, the midpoint of this range of estimates was chosen; that is, a 10-percent rise in income would result in an 8.5-percent rise in per capita meal and snack expenditures. Assuming that real (adjusted for inflation) per capita income rises to \$5,267 by 1990, and that population totals 252 million, inflation-adjusted sales of eating places would be expected to rise 18 percent between 1983 and 1990, compared with the 21-percent rate of growth experienced from 1976 to 1983. However, changes in the age and geographic distribution of the population, household size, consumer preferences, and other factors such as improved marketing and merchandising efforts may further enhance the growth in sales.

Battle for Market Shares

Grocers are stepping up their battle for market shares. One strategy is to open different types of outlets that appeal to a variety of consumer groups. The result is the creation of a host of new formats, such as superstores, discount outlets, upscale warehouse stores, and gourmet markets.

The trend is toward more variety, services, and products because more women are working outside the home, reducing the time available to travel from grocery to pharmacy to delicatessen to bakery and beyond. The industry, then, has turned to "one-stop shopping" to capture their food dollars.

Another strong incentive for building large stores filled with specialty offerings is higher profits. After-tax earnings of the Nation's 29,000 supermarkets average only 1 percent of total sales. Gross-profit margins—the average markup on the cost of their goods—run around 20 percent for food products, but are 30 percent for

cosmetics, up to 40 percent for deli fare, and 45 percent for flowers.

For similar reasons, an increasing number of stores now offer fresh pasta, fancy cheeses, fresh seafood, and varieties of coffees, nuts, and honey—all high-profit items that are traditionally associated with gourmet or specialty shops. Even the no-frill stores are affected by the trend toward specialty foods. Some now combine the low prices and stark motif of warehouse outlets, with specialty sections and upgraded produce departments.

Supermarkets are experimenting with on-site bakeries, delicatessens with a wide array of freshly prepared and ready-to-eat foods, expanded sections of upscale frozen-prepared foods ready for heating in a microwave oven, salad and juice bars, bulk foods, and natural food centers. At one of the nation's largest supermarket chains, produce sections that not too long ago carried 60 items, now bulge with 180 different offerings, including 13 kinds of melons.



Fats and Oils: Consumers Use More, But Different Kinds

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Evidence linking saturated fat with heart disease, along with concerns over obesity, has dramatically affected consumption of fats and oils in the United States. In 1960, per capita consumption amounted to almost 119 pounds (table 1). Although the amount climbed to 129 pounds in 1970, by 1982 it had inched ahead only another 1.2 pounds per person.

In addition, there has been a shift from animal to vegetable sources of fats and oils, reflecting consumers' efforts to switch from saturated to polyunsaturated fats and oils and expansion of U.S. oilseed production. In 1960, fats and oils from animals represented 70 percent of the total (figure 1). By 1982, the share had fallen to 57 percent.

As a result of the shift to vegetable fats and oils, the share of saturated fat in the diet decreased from 37 percent in 1960 to 33 percent in 1982. Most of this decline was offset by an increase in the percentage of polyunsaturated fat in the diet. Thus, while total fat consumption has increased, from a nutritional standpoint, there has been a positive change in the types of fats consumed.

There are Invisible Fats ...

Fats and oils in the diet are classified as "invisible" and "visible." The invisible ones—those naturally in foods such as meat, eggs, or dairy products—account for about 50-60 percent of the total and provide 65 percent of our saturated fat, a share that has varied little over time.

Red meat, poultry, and fish are the greatest source of invisible fat, accounting for 34 percent of the total, and 40 percent of the saturated fat in the diet in 1982. Beef, pork, and lamb average 20 to 25 percent fat, depending on the type of cut; poultry and fish about 5 percent. Eggs, which are 10 percent fat, contributed 3 percent to total fat consumed in 1982.

The fat content of dairy products ranges from 1 percent for nonfat dry milk to 10-15 percent for ice cream, and 30 percent or more for cheese. Over the last 50 years, there has been a decrease in per

Table 1. U.S. Average Per Capita Consumption of Visible and Invisible Fats and Oils¹

| | 1940 | 1950 | 1960 | 1970 | 1982 |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|
| | Pounds | | | | |
| Visible fats and oils | | | | | |
| Baking and frying fats | 8.8 | 10.9 | 12.6 | 17.3 | 18.8 |
| Salad and cooking oils | 7.3 | 8.5 | 11.5 | 17.7 | 23.3 |
| Margarine | 1.9 | 4.9 | 7.5 | 8.6 | 8.9 |
| Butter | 13.4 | 8.5 | 6.0 | 4.2 | 3.6 |
| Lard | 14.2 | 12.4 | 7.6 | 4.6 | 2.3 |
| Tallow | 0 | 0 | 0 | 0 | 1.3 |
| Total, visible | 45.6 | 45.2 | 45.2 | 52.4 | 58.2 |
| Invisible fats and oils | | | | | |
| Meat, poultry, and fish | 31.8 | 37.8 | 43.9 | 48.1 | 44.3 |
| Dairy products | 17.4 | 20.1 | 17.0 | 15.2 | 15.3 |
| Eggs | 3.8 | 4.9 | 4.4 | 4.0 | 3.4 |
| Vegetables, fruits, nuts, etc. | 8.9 | 8.5 | 8.0 | 8.6 | 9.1 |
| Total, invisible | 61.9 | 71.3 | 73.3 | 75.9 | 72.1 |
| Total | 107.5 | 116.5 | 118.5 | 128.3 | 130.3 |

¹ Fat content basis.

capita whole milk and cream consumption, leading to a decline in fat from these sources. This was partially offset, however, by increased consumption of whole milk cheeses. Consumption of fat in dairy products has varied little over the last 10 years. In 1982, dairy products made up 12 percent of total fat consumed, and 20 percent of saturated fat, compared to 16 percent and 25 percent in 1940.

Vegetable sources also constitute a small share of total invisible fats in our diets. Nuts contribute about 4 percent to total fat, while lesser amounts come from coffee and cereal products. Fruits and vegetables are very minor sources of fat in the diet, adding only about 0.7 percent.

... And Visible Fats

Visible fats and oils are those added to foods, either directly in the form of spreads and salad dressings, or as ingredients in meals, bakery products, and other processed foods. Home use comprises the largest share of visible fats—30.2 percent. Ingredients in prepared baked goods accounted for 7.4 percent of total visible fats and oils in 1982, while canned foods contributed 6.8

percent, and frozen foods, 6.3 percent. Potato and corn chips added another 6 percent to the total visible fats and oils consumed.

Restaurant use of fats and oils rose 69 percent between 1969 and 1979, primarily due to the increase in fast food outlets and other establishments specializing in fried foods such as chicken, fish, and french-fried potatoes. Restaurants accounted for 19.7 percent of visible fats and oils consumed in 1982, compared with 12.9 percent in 1969.

The quantity and type of visible fats consumed in the United States have changed dramatically since the turn of the century, with animal fats becoming much less important as a source. Between 1950 and 1982, the share of fats and oils from vegetable sources increased from 28 to 43 percent. The use of fluid vegetable oils, in particular, has shown a dramatic change—rising from 5 pounds per person in 1950 to 23 pounds in 1982. The greater use of fluid oils, which contain a higher percentage of polyunsaturated fatty acids than do more solid forms of fats and oils, has helped lower the share of saturated fat in our diets.

The expansion of the U.S. soybean industry brought about a dramatic increase in the supply of soybean oil at competitive prices. Furthermore, improvements in processing techniques since 1950 have permitted production of shortening and margarine made entirely from vegetable oils. Consumers, concerned about saturated fat and cholesterol intake and attracted to the lower price, have quickly switched to these vegetable-based products.

Butter consumption decreased 38 percent from its peak of 18.5 pounds per person in 1932 to 4.5 pounds in 1982, as consumers substituted margarines produced with vegetable oils. Margarine consumption, only 1.6 pounds per person in 1932, is now more than double that of butter. Price is certainly a factor in this switch, with margarine averaging less than half the price of butter.

Direct use of lard by consumers has shown a decline similar to that of butter, falling from its peak of 13.8 pounds per capita in 1942 to only 2.3 pounds in 1982. Lard remains an important ingredient in shortening and margarine, though its use in these products is declining.

The consumption of beef tallow has increased over the last 10 years, mainly due to use by the fast food industry for deep-fat frying. Along with lard, tallow is also contained in shortening and margarine. In fact, both tallow and lard remain second only to soybean oil in their use in the production of food fat and oil products (table 2).

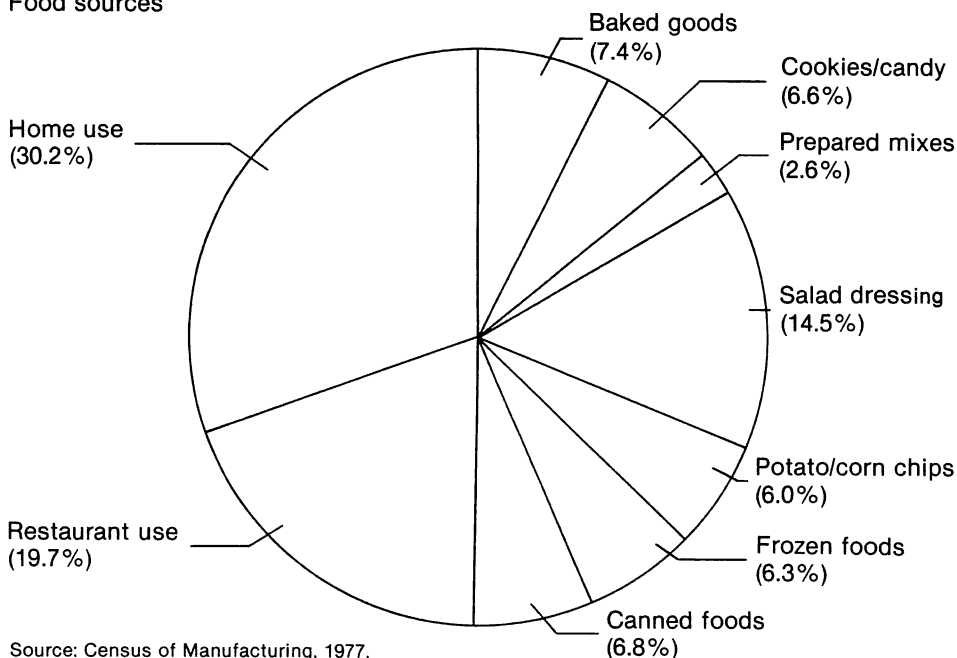
Animal, Vegetable, or Both?

Consumers face an often overwhelming choice of fats and oils products, including many types and brands of shortening, salad oils, and margarines. Each of these can be composed of one oil or a blend of either animal or vegetable fats and oils or both. In turn, vegetable shortenings, oils, and margarines can contain any number of vegetable oils: soybean, cottonseed, palm, or coconut.

Corn oil margarine, safflower oil, and olive oil are examples of products made from a single source. In contrast, products labeled simply "vegetable oil" or

Figure 1

Visible Fats and Oils Food sources



Source: Census of Manufacturing, 1977.

Table 2. Fats and Oils Used in Food Products, 1982-83¹

| Item | Salad and cooking oil | Baking and frying fat | Margarine | Other edible | Total |
|----------------|-----------------------|-----------------------|-----------|--------------|--------|
| Million pounds | | | | | |
| Soybean | 4,668 | 2,944 | 1,615 | 58 | 9,285 |
| Cottonseed | 444 | 122 | 31 | 16 | 633 |
| Corn | 395 | — | 217 | — | 637 |
| Coconut | — | 164 | — | 146 | 340 |
| Palm | — | 206 | — | — | 272 |
| Peanut | 162 | — | — | — | 174 |
| Sunflower | — | — | — | — | 73 |
| Tallow | 0 | 616 | 7 | NA | 1,066 |
| Lard | 0 | 252 | 24 | NA | 730 |
| Total | 5,835 | 4,356 | 1,906 | 368 | 12,465 |

¹Year beginning Oct. 1, 1982.

— = Withheld to avoid disclosing information for individual companies.

"vegetable margarine" are made from a combination of oils, though primarily soybean oil. Similarly, vegetable shortenings are usually composed of a blend of soybean, cottonseed, and either palm or coconut oils.

Margarine and shortening are also available in blends that contain vegetable oils and animal fat. Twenty percent of the fats and oils in these shortenings are animal fat, primarily beef tallow, while margarines contain only 2 percent from animal sources.

Soybean oil has emerged as the leading vegetable oil used in these products, offsetting the decline in cottonseed oil, once the major vegetable oil used in the United States. Expansion of soybean production over the last 30 years made soybean oil abundant and lower priced than other oils. Greater use of soybean oil has positive nutritional implications since it has a higher ratio of polyunsaturated to saturated fatty acids than does cottonseed oil (table 3).

Increased attention to the benefits of polyunsaturated fats has also led to more oils and margarines made from sunflower and safflower oils, which have an even higher ratio of polyunsaturates to saturated fatty acids. Manufacturers have created a new market segment by advertising the health benefits of these products and consumers have been willing to pay higher prices than for soybean oil products. Sunflower and safflower oils, however, still represent only about 3 percent of total oils used.

As consumers increasingly respond to concerns about fat intake, knowledge of how fat and oil products are produced becomes important. For example, while the ingredient oils influence the level of saturated fats in shortening, salad and cooking oils, and margarine, so can the production process called hydrogenation.

Hydrogenation, developed in the early 1900's, is the chemical alteration of the structure of oils to produce a solid product, such as shortening. Some highly saturated fats and oils such as those from animals, coconuts, and palms are naturally solid at room temperature, while others solidify only through hydrogenation.

Technological improvements in the last two decades have resulted in more control over the process. The manufacturer can now stop the hydrogenation at any point to meet the physical and chemical characteristics desired in the final product. As a result, consumers can now choose among an array of solid, semi-solid, and liquid shortenings and margarine, as well as liquid vegetable oils.

The hydrogenation process also increases the chemical stability of fats and

Table 3. Fatty Acid Composition of the Principal Fats and Oils Used in Edible Products

| Item | Saturated | Mono-unsaturated | Poly-unsaturated ¹ |
|------------|-----------|------------------|-------------------------------|
| | Percent | | |
| Soybean | 14 | 24 | 62 |
| Cottonseed | 26 | 22 | 52 |
| Corn | 14 | 29 | 57 |
| Peanut | 21 | 49 | 30 |
| Olive | 15 | 73 | 12 |
| Safflower | 10 | 14 | 75 |
| Sunflower | 11 | 19 | 70 |
| Coconut | 93 | 6 | 1 |
| Palm | 57 | 36 | 7 |
| Tallow | 51.1 | 44.0 | 4.9 |
| Lard | 44 | 46 | 10 |

¹Polyunsaturates are used as a residual category, especially for lard and tallow.

Source: Institute of Shortening and Edible Oils

Table 4. Fatty Acid Composition of Food Fats and Oils

| | Saturated | Mono-unsaturated | Poly-unsaturated |
|-----------------------------------|-----------|------------------|------------------|
| | Percent | | |
| Shortening | | | |
| Vegetable | | | |
| Before hydrogenation ¹ | 23 | 20 | 57 |
| After hydrogenation | 22-32 | 44-55 | 33 |
| Vegetable/animal blend | 30-50 | 37-57 | 13 |
| Animal | 34-45 | 44-53 | 20 |
| Margarines | | | |
| Vegetable | | | |
| Before hydrogenation | 14 | 23 | 63 |
| After hydrogenation | | | |
| stick | 17-25 | 35-66 | 29 |
| tub | 15-23 | 22-48 | 46 |
| liquid | 10-17 | 14-36 | 61 |
| Animal | 36-41 | 52-57 | 7 |
| Salad oils | | | |
| Before hydrogenation | 15 | 22 | 63 |
| After hydrogenation | 15 | 50 | 35 |
| Butter | 63-70 | 28-31 | 2 |

¹Based on fatty acid composition of fats and oils used in manufacture (table 3).

oils, which reduces rancidity and thereby increases shelf life. As a result, even liquid fat and oil products are lightly hydrogenated to improve keeping quality. This is especially important for soybean oil which is more subject to rancidity than other oils because of its higher proportion of unsaturated fats.

While hydrogenation yields a wider

variety of more stable products, it also has nutritional implications because it changes the degree of saturation of the final product. In the hydrogenation process, polyunsaturated fats are converted into either monounsaturated or fully saturated fatty acids. In recent years, technical advances have given manufacturers more control over the degree of satura-



Food Programs Grow Slowly From 1979 to 1983

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tion in the final product. However, the conversion of unsaturates into saturated fats is not completely avoidable.

The hydrogenation of soybean, cottonseed, and corn oils decreases the amount of polyunsaturated fats in margarine by 35 percent, while increasing the saturated fat by 3 to 11 percent (table 4). For household shortening, there is a 30-percent decrease in polyunsaturated fats and an 8- to 18-percent increase in saturation. The light hydrogenation of salad oils results in the conversion of 35 percent of the polyunsaturated fats into monounsaturates, with little change in the amount of saturated fat.

Consumer Guidelines

Choosing the most healthful form of fats and oils can be confusing. Here is some information to help in the selection:

- Fats and oils that are solid at room temperature contain more saturated fat than those that are liquid. Liquid semi-soft fats and oils made from vegetable oils provide the lowest degree of saturated fats.

- Only animal products contain cholesterol. To reduce cholesterol intake, lower consumption of animal fats, and any processed fats and oils (shortenings and margarine) that contain animal fats.

- Read the labels carefully to determine the oils used in the production of margarine and shortening. Lower priced margarine or shortening is likely to contain animal fats. Soybean, corn, safflower, and sunflower oils have a higher ratio of polyunsaturated to saturated fatty acids than do palm, coconut, peanut, or cottonseed oils.

- Read the label on processed foods to determine the type of fats and oils used as ingredients. Many brands of cookies, crackers, and baked goods contain lard, tallow, or highly saturated vegetable oils.

- Diet or imitation margarine contains about 60 percent fat compared to 80 percent for regular margarine. The calorie reduction is about 20 percent; 100 calories per tablespoon for regular margarine, versus 80 calories for imitation margarine. Water or nonfat dry milk is used in place of fat in these products.

- Persons attempting to lower total fat consumption should be aware of the invisible fat in their diet, as well. Lean meat, poultry, fish, skim or low fat milk, and cheeses made from partially skimmed milk are products with lower levels of fat.

The growing awareness of domestic hunger problems in the 1970's generated increased food program benefits, uniform eligibility requirements, and outreach activities to encourage participation. With debate over the Federal budget, much of the legislation of the 1980's has been designed to slow the rate of growth in the Federal food assistance programs by freezing benefit levels, tightening eligibility standards, and reducing assistance to non-needy persons.

These changes have had an impact on Federal expenditures. Preliminary data show that Food and Nutrition Service (FNS) food program costs amounted to \$17.9 billion in 1983, up 7 percent in real (adjusted for inflation) dollars from 1981. This compares with a 30-percent rise between 1978 and 1980, when costs in 1983 dollars went from \$12.1 to \$15.8 billion.

Family Food Programs

Legislative changes in the Food Stamp Program (FSP) reduced the number of persons eligible. Estimates by the Economic Research Service show that approximately 1 million additional persons would have participated in the FSP in 1983 if 1979 eligibility standards had still been in effect.

Higher unemployment was largely responsible for boosting average participation from 16.9 million a month in 1979 to 21.6 million persons a month in 1983. Unemployment averaged 5.8 percent in 1979, compared to 9.6 percent in 1983. USDA estimates that each additional percentage point increase in the unemployment rate results in about 1 million persons joining the FSP.

FSP costs, by far the major portion of USDA's food program budget, totaled \$11.9 billion last year, of which \$11.1 billion were for benefits (table 1). In 1979, benefits amounted to \$7.1 billion. Average monthly benefits per person were \$31.63 in 1979 and \$42.87 last year.

The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35) was one of several legislative acts passed in the early 1980's to help control the Federal budget.

For the FSP, the Act established gross income eligibility standards for all households, except those with elderly or disabled persons. Households with a gross monthly income exceeding 130 percent of the Federal poverty level set by the Office of Management and Budget (OMB) are no longer eligible to participate. Moreover, the Act mandated stricter food stamp eligibility standards for households with members involved in labor strikes.

Households with elderly or disabled members are allowed slightly different deductions. For example, they may take separate deductions for dependent care and shelter costs. In addition, they are allowed to deduct all medical expenses that exceed \$35 a month.

The Omnibus Budget Reconciliation Acts of 1981 and 1982 instituted major changes in the allowable deductions from gross income (*see insert*). The 1981 Act delayed cost-of-living adjustments for food stamp benefits and temporarily reduced the frequency of adjustments in the amount of the standard and dependent care/excess shelter deductions. Further, the earned income deduction for working households was lowered from 20 percent to 18 percent of earnings. Other changes included prorating the initial month's benefits based on the application date.

The 1982 Act (P.L. 97-253) delayed adjustments in the standard, medical, and dependent care and excess shelter deductions, required rounding down deductions and benefit payments to the nearest whole dollar, and tightened eligibility standards for students. Food stamp benefits were also temporarily reduced so that households with no net income now receive benefits equal to the cost of the Thrifty Food Plan (TFP), less 1 percent. Previously, benefits equaled the full cost of the TFP, which is the least costly of four food plans developed by USDA's Human Nutrition Information Service. The plan specifies the amounts of 31 different groups of food that households might use to obtain a nutritious diet.

In an effort to control program costs in Puerto Rico, the 1981 Act replaced the

Table 1. Federal Cost of USDA Food Programs, Calendar Years, 1979-83¹

| Program | | | | | | 1983 (Quarters) ² | | | |
|--|--------|--------|--------|--------|-------------------|------------------------------|-------|-------|-------|
| | 1979 | 1980 | 1981 | 1982 | 1983 ² | I | II | III | IV |
| Million dollars (Current) | | | | | | | | | |
| Family Food | | | | | | | | | |
| Food Stamps | 7,108 | 9,004 | 10,968 | 10,375 | 11,113 | 2,919 | 2,796 | 2,675 | 2,723 |
| Nutr. Asst. Prog. in Puerto Rico ³ | — | — | — | 396 | 780 | 196 | 192 | 197 | 195 |
| Commodity Distribution | | | | | | | | | |
| Needy Families | 22.5 | 23.5 | 31.1 | 30.2 | 34.1 | 6.8 | 8.7 | 9.7 | 8.9 |
| Schools ⁴ | 720 | 967 | 832 | 786 | 834 | 266 | 157 | 160 | 250 |
| Other ⁵ | 85 | 115 | 111 | 173 | 220 | 54 | 56 | 54 | 56 |
| Special Distribution ⁶ | — | — | — | 304 | 1,185 | 289 | 368 | 268 | 260 |
| Cash in Lieu of Commodities ⁷ | 62 | 85 | 110 | 114 | 130 | 23 | 35 | 42 | 30 |
| Child Nutrition ⁸ | | | | | | | | | |
| School Lunch | 2,101 | 2,395 | 2,283 | 2,245 | 2,441 | 786 | 580 | 321 | 754 |
| School Breakfast | 243 | 311 | 330 | 327 | 356 | 111 | 86 | 49 | 110 |
| Special Food ⁹ | 288 | 338 | 401 | 361 | 410 | 84 | 96 | 149 | 81 |
| Special Milk | 146 | 137 | 72 | 19 | 17 | 5 | 4 | 4 | 4 |
| Nonfood Assistance ¹⁰ | 24 | 20 | 12 | — | — | — | — | — | — |
| WIC ¹¹ | 569 | 783 | 863 | 1,002 | 1,203 | 266 | 276 | 324 | 337 |
| Total ¹² | 11,369 | 14,179 | 16,010 | 16,132 | 18,723 | 5,006 | 4,655 | 4,253 | 4,809 |

¹Administrative costs are excluded unless noted. ²Preliminary. ³Puerto Rico transferred from the Food Stamp Program to a substitute nutrition assistance program on July 1, 1982. ⁴Includes child care centers and camps participating in the Child Care and Summer Food Service Programs. ⁵Commodity Supplemental Food Program, Nutrition Program for the Elderly, and donations to charitable institutions. ⁶Initiated December 1981. ⁷Child Nutrition Programs and the Nutrition Program for the Elderly. ⁸Cash expenditures. Includes money donated for local purchase of food. ⁹Divided into Child Care Food Program and Summer Food Service Program (SFSP) in fiscal 1976. Includes administrative costs for SFSP. ¹⁰Nonfood assistance was terminated on October 1, 1981. ¹¹Special Supplemental Food Program for Women, Infants, and Children. Includes administrative costs. ¹²May not add due to rounding.

Source: Computed from monthly data supplied by the Food and Nutrition Service.

FSP there with the Nutritional Assistance Program (NAP) on July 1, 1982. The NAP was established with a fixed appropriation \$275 million below Puerto Rico's food stamp funding for 1982, meaning that the number of participants or benefits had to be adjusted to accommodate the reduced amount of funding. Compared to the 1982 FSP, average participation was 13.8 percent lower in 1983, while average benefits were constant. An average of 1.6 million residents of Puerto Rico participated in the NAP in 1983. Benefits totaled \$780.3 million.

Child Nutrition Programs

Figure 1 depicts 1979 to 1983 average participation in the National School Lunch Program (NSLP) and School Breakfast Program (SBP). During this

period, NSLP participation declined 14.1 percent, from 27.0 million to 23.3 million, while SBP participation remained constant at about 3.4 million persons.

Two factors led to the drop in NSLP participation. School enrollments declined 5.3 percent between 1979 and 1982. More importantly, however, several legislative changes were implemented which reduced NSLP costs while minimizing the impact on needy children. For example, the Omnibus Budget Reconciliation Act of 1981 excluded private schools with an average annual tuition of \$1,500 or more per child from participating in the child nutrition programs. In addition, lower reimbursement rates for paid meals led to higher meal prices which reduced participation (table 2). The maximum charge for a reduced-price lunch doubled to 40

cents. Income eligibility requirements for free and reduced-price meals were tightened so that fewer students qualified.

As a result of these changes, the proportion of free lunches increased from 1979 to 1983, while those served at reduced or full price declined. About 44 percent of the meals served in 1983 were free, 7 percent were reduced-price, and 49 percent were full-price. Corresponding numbers for 1979 were 37 percent, 6 percent, and 56 percent.

Cash expenditures for the NSLP amounted to \$2.5 billion in 1983, including \$17.4 million for cash in lieu of commodities. Expenditures for the SBP totaled \$356.6 million. In addition to cash, USDA also provided schools with commodity reimbursements and "bonus"

Food Stamp Program Deductions

Deductions are made from gross income to derive a household's net income which is then used as the basis for determining the amount of food stamp benefits. All households are entitled to a standard deduction. Households may subtract expenses for the care of dependents, shelter costs which exceed 50 percent of the household's income after all other deductions, or a combination of both. Dependent care costs are the payments for care of children, elderly, or disabled adults necessary for a household member to work, actively seek employment, or receive training. A deduction is also allowed for earned income.

Households with elderly or disabled members are allowed slightly different deductions. For example, they may take separate deductions for dependent care and shelter costs. In addition, they are allowed to deduct all medical expenses that exceed \$35 a month.

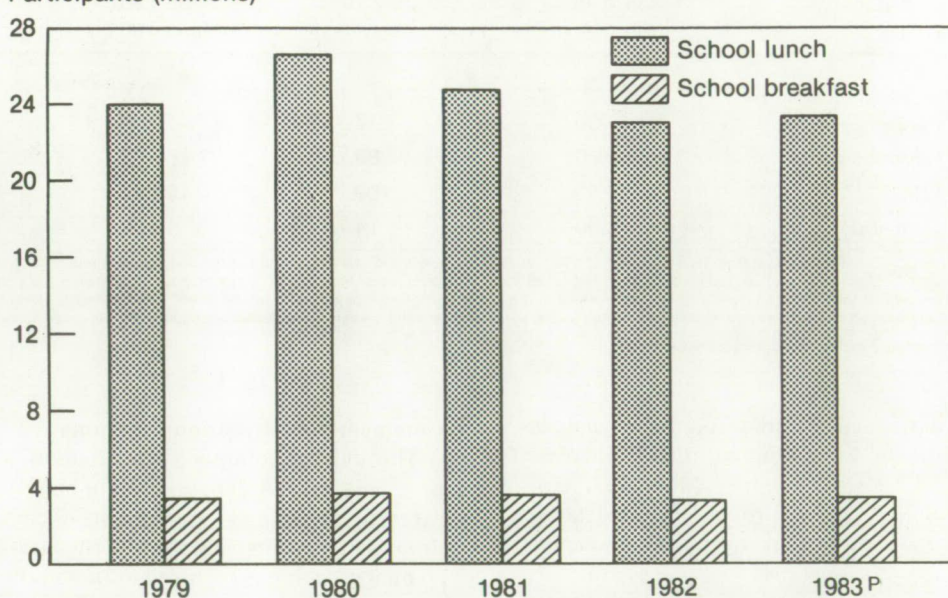
commodities from stocks acquired under Federal agricultural price support efforts.

About 185 million half pints of milk were served under the Special Milk Program (SMP) in 1983, an 89.7-percent decline from 1979 (figure 2). This dramatic decrease was due to a provision of the Omnibus Budget Reconciliation Act of 1981 that limits the SMP to schools that do not participate in any other child nutrition program. Federal expenditures for the SMP fell from \$146.7 million in 1979 to \$17.6 million in 1983.

USDA contributed \$96.8 million to the Summer Food Service Program in 1983, providing meals to an average of 1.1 million children a month in June, July, and August. The number of participants has declined 31.3 percent from 1979 primarily due to stricter eligibility requirements mandated by the Omnibus Budget Reconciliation Act of 1981.

Figure 1

Participation in the School Lunch and School Breakfast Program



P=Preliminary.

Source: Food and Nutrition Service.

Participation in the Child Care Food Program (CCFP) rose from an average of 616,000 children in 1979 to 924,000 in 1983, largely due to a twofold increase in the number of outlets operating the program. Under the CCFP, meal service is available to all children attending child-care centers and day-care homes participating in the program. Free or reduced-price meals represented 85 percent of all meals served in 1983, compared with 80 percent in 1979. Meal costs including cash in lieu of commodities totaled \$341.5 million in 1983, up from \$188.5 million in 1979.

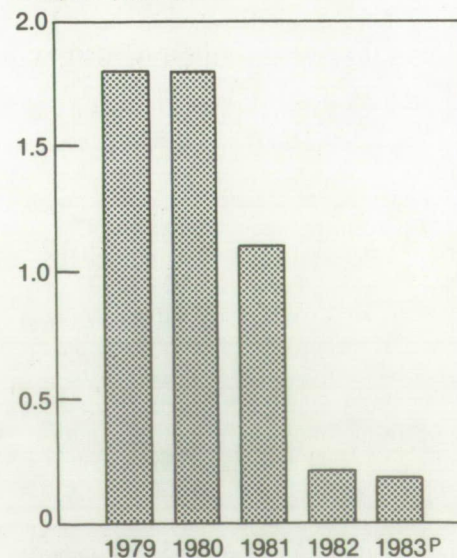
Supplemental Food Programs

Much of the increase in the supplemental food programs occurred in the 1970's, and these programs have continued to grow. Participation in the Special Supplemental Food Program for Women, Infants, and Children (WIC) reached a record high of 2.7 million persons in 1983, an increase of 66.7 percent from 1979 (figure 3). Similarly, average

Figure 2

Milk Served in the Special Milk Program

Half pints (billions)



P=Preliminary.

Source: Food and Nutrition Service.

Table 2. National School Lunch Program Cash Payment and Commodity Rates

| Category | 1980-81 school year | 1981-82 school year ¹ | | 1982-83 school year | 1983-84 school year |
|--------------------------|---------------------------------------|---------------------------------------|--|---------------------------------------|---------------------------------------|
| | Jan. 1981 - June 1981 ² | July 1981 - Aug. 1981 ² | Sept. 1981 - June 1982 ³ | July 1982 - June 1983 ³ | July 1983 - June 1984 ³ |
| | Cents per meal | | | | |
| Paid | 16.00 | 17.75 | 10.50 | 11.00 | 11.50 |
| Reduced-price | 63.50 | 89.25 | 69.25 | 75.00 | 80.25 |
| Free | 83.50 | 109.25 | 109.25 | 115.00 | 120.25 |
| Commodities ⁴ | 13.50 | 14.75 | 11.00 | 11.50 | 11.50 |

¹The Omnibus Budget Reconciliation Act of 1981 authorized lower cash payments and commodity rates effective September 1981. In the absence of this Act, the rates in effect from July 1981 through August 1981 would have remained in effect the entire school year. ²Cash payment rates were 2.5 cents higher for school food authorities who served more than 60 percent of their lunches free or at reduced prices in the second prior school year. ³Cash payment rates were 2.0 cents higher for school food authorities who served more than 60 percent of their lunches free or at reduced prices in the second prior school year. ⁴The basic commodity rate is given to schools for each lunch served.

Source: Food and Nutrition Service.

participation in the Commodity Supplemental Food Program (CSFP) increased 38.3 percent, from 99,400 to 137,500. Both programs provide food assistance to low-income women, infants, and children at nutritional risk.

Increased appropriations for WIC enabled more people to participate in the program. For example, in 1983 the Emergency Food Assistance Act (P.L. 98-8) authorized \$100 million in addition to the fiscal 1983 appropriation, extending WIC assistance to approximately 500,000 additional participants.

Greater stocks of surplus foods contributed to higher participation in the CSFP. Under the program, participants receive surplus foods such as dairy products, as well as federally purchased foods such as juices, canned meat and poultry, and egg mix.

Federal expenditures for WIC rose by 115 percent between 1979 and 1983, from \$569.3 million to \$1.2 billion. By law, at least 80 percent of the funds appropriated for WIC are used to pay the costs of specified supplemental foods, such as formula, iron-fortified infant cereal, and fruit juices for participants. The remaining funds are for nutrition education and other administrative expenses.

CSFP expenditures amounted to \$39.3 million in 1983, with food costs representing 86 percent or \$33.8 million. In 1979, food costs totaled \$17.7 million.

Commodity Distribution Programs

Through the commodity distribution programs, USDA donates food to help meet the nutritional requirements of children, needy adults, and the elderly. Substantial growth has occurred in these programs in recent years, mainly in response to the accumulation of large Government stocks of surplus commodities. Commodity distribution accounted for about 7 percent of the total Federal expenditures for all domestic food programs in 1979. In 1983, the special distribution of surplus commodities, primarily cheese, boosted the share to 12 percent.

In 1983, schools received commodity reimbursements and bonus commodities worth \$821.2 million, up from \$717.9 million in 1979. The value of bonus commodities rose from about \$69.6 million in 1979 to \$390.6 million in 1983. The 1983 bonus donations included cheese, butter, nonfat dry milk, wheat, honey, rice, grapefruit juice, turkey, chicken, and beef.

Food costs for the Needy Family Program (NFP) amounted to \$34.1 million in 1983, compared with \$22.2 million in 1979. Under this program, foods are distributed to low-income Native American households on or near reservations and to low-income households in the Trust Territories of the Pacific Islands. Partici-

pation in the NFP rose 15.5 percent, from an average of 86,900 participants in 1979 to 100,400 in 1983, largely due to more reservations joining the program.

The Nutrition Program for the Elderly (NPFE) provided an average of 778,300 meals a day in 1983, up from about 600,000 in 1979. Food costs more than doubled during this period, climbing from \$55.3 million to \$112.0 million. Cash in lieu of commodities increased by 156 percent while the value of commodities distributed through the NPFE declined by 15 percent. State agencies participating in the NPFE may receive cash, commodities, or both. In 1983, 21 received cash and commodities, 34 received cash only, and 1 chose to receive commodities only. In general, the same commodities provided to schools are available to the NPFE.

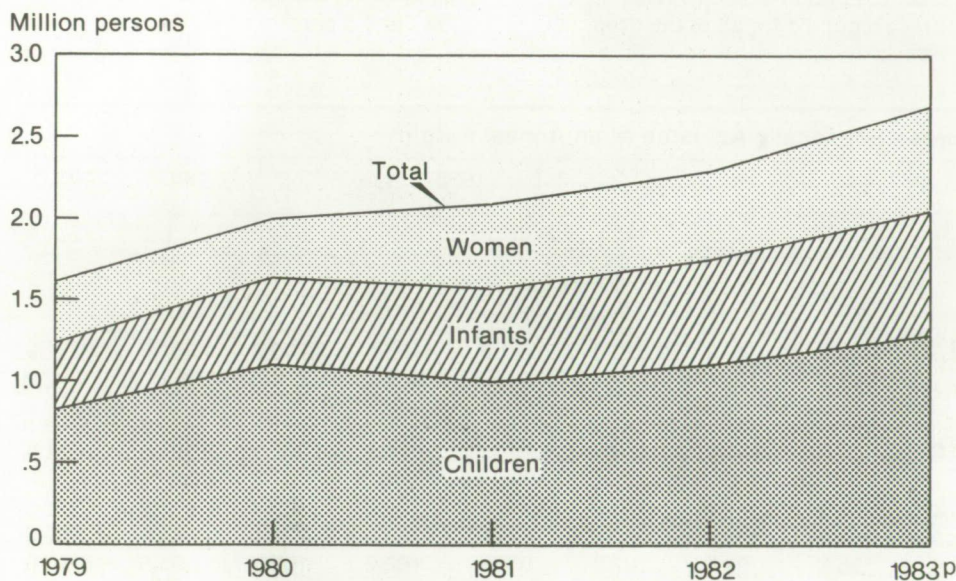
In 1981, the President established a special food distribution program designed to provide food assistance and reduce mounting Government stocks (see *NFR-24*). From the initial distribution of processed American cheese, the program has expanded to include butter, instant nonfat dry milk, cornmeal, rice, flour, and honey. Food valued at \$1.2 billion was provided to States in 1983 for donation to needy persons under this special food distribution program.

Income and Food Expenditures Continue to Rise

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Figure 3

Participants in the WIC Program¹



¹WIC is the Special Supplemental Food Program for Women, Infants, and Children.

P Preliminary.

Source: Food and Nutrition Service.

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The U.S. Department of Commerce releases monthly, quarterly, and annual estimates of Disposable Personal Income and its allocation among Personal Consumption Expenditures, Personal Savings, Interest Paid by Consumers to Business and Personal Transfer Payments to Foreigners. The monthly and quarterly estimates are adjusted to eliminate seasonal fluctuations so that trends can be readily discerned and put on an annual basis for comparing the three series.

With the economic recovery continuing, the Nation's Disposable Personal Income (DPI) climbed again in the fourth quarter of 1983 to \$2.4 trillion (seasonally adjusted at an annual rate), 2.6 percent above the previous quarter and 8.8 percent higher than a year earlier (table 1).

Personal Consumption Expenditures (PCE) totaled 92 percent of DPI, or \$2.2 trillion. This represents a 2.3-percent increase over the previous 3 months. While consumers spent more, they also increased their savings by 8.5 percent to \$126 billion, or 5.2 percent of DPI.

Food Spending—At Home and Away

Consumers continued to spend more on food in the fourth quarter of 1983. Food price increases of 0.3 percent and higher DPI boosted total food expenditures to \$378 billion, 0.9 percent more than the previous quarter and 6.5 percent above a year earlier.

Food expenditures amounted to 15.6 percent of DPI, with 11.2 percent spent for food at home and 4.4 percent for food away from home.

Food-at-home expenditures were \$271 billion, 0.9 percent higher than the previous quarter, and 5.7 percent above a year earlier. Expenditures for food at home made up over 72 percent of the PCE for food.

Consumer spending in restaurants and other eating places rose 8.6 percent from year-earlier levels, totaling \$107 billion in October-December 1983. Americans spent 1 percent more on food away from home than in the previous quarter. Higher disposable personal incomes

resulting from a stronger economy helped boost these expenditures.

Overall, the proportion of DPI spent for food fell from 16 percent in 1982 to

15.9 percent last year, marking the first time annual PCE for food fell below 16 percent. Food-at-home expenditures accounted for all of the drop, fall-

ing from 11.6 percent in 1982 to 11.4 percent in 1983. Expenditures for food away from home, however, rose from 4.4 in 1982 to 4.5 percent of DPI spent for food.

Table 1. Personal Consumption Expenditures—Seasonally Adjusted at an Annual Rate¹

| Item | 1982 | | | | 1983 | | | | 1982 ² | 1983 ² |
|---|---------|---------|---------|---------|---------|---------|---------|---------|-------------------|-------------------|
| | I | II | III | IV | I | II | III | IV | | |
| Billion dollars (current) | | | | | | | | | | |
| Total personal consumption expenditures | 1,938.9 | 1,972.8 | 2,008.8 | 2,046.9 | 2,073.0 | 2,147.0 | 2,181.1 | 2,230.9 | 1,991.9 | 2,158.0 |
| Nondurables | 749.7 | 754.7 | 766.6 | 773.0 | 777.1 | 799.6 | 814.8 | 825.0 | 761.0 | 804.1 |
| Food, beverages, and other groceries | 449.5 | 458.0 | 465.3 | 471.8 | 479.0 | 487.7 | 498.1 | 502.6 | 461.1 | 491.8 |
| Food, exc. alcoholic beverages | 339.4 | 345.4 | 351.3 | 355.3 | 361.8 | 369.0 | 375.0 | 378.4 | 347.8 | 371.0 |
| At home | 248.2 | 251.9 | 254.7 | 256.5 | 259.2 | 265.0 | 268.8 | 271.1 | 252.8 | 266.0 |
| Away from home | 91.2 | 93.5 | 96.6 | 98.8 | 102.6 | 104.0 | 106.2 | 107.3 | 95.0 | 105.0 |
| Alcoholic beverages | 48.7 | 49.2 | 49.2 | 49.3 | 49.9 | 50.6 | 51.3 | 52.2 | 49.1 | 51.0 |
| At home | 30.8 | 31.1 | 30.7 | 30.5 | 30.6 | 31.1 | 31.6 | 32.1 | 30.8 | 31.4 |
| Away from home | 17.9 | 18.1 | 18.5 | 18.8 | 19.3 | 19.5 | 19.7 | 20.1 | 18.3 | 19.6 |
| Cleaning & household supplies | 21.9 | 22.3 | 22.5 | 22.7 | 22.8 | 23.4 | 23.7 | 23.9 | 22.3 | 23.5 |
| Toiletries | 16.5 | 16.9 | 17.0 | 17.2 | 17.6 | 17.9 | 18.1 | 18.4 | 16.9 | 18.0 |
| Tobacco | 23.0 | 24.2 | 25.3 | 27.3 | 26.9 | 26.8 | 30.0 | 29.7 | 25.0 | 28.3 |
| Drugs | 19.4 | 19.9 | 20.1 | 20.3 | 21.4 | 21.5 | 21.9 | 22.0 | 19.9 | 21.7 |
| Clothing and shoes | 118.4 | 119.0 | 119.2 | 119.6 | 120.0 | 126.4 | 125.1 | 130.7 | 119.0 | 125.6 |
| Gas and oil | 94.0 | 89.6 | 91.3 | 91.1 | 87.3 | 90.3 | 93.1 | 92.7 | 91.5 | 90.8 |
| Fuel oil and coal | 19.4 | 19.6 | 20.9 | 20.2 | 17.7 | 21.2 | 23.0 | 22.3 | 20.0 | 21.1 |
| Other | 49.0 | 48.6 | 49.8 | 50.0 | 51.7 | 52.5 | 53.6 | 54.7 | 49.5 | 53.1 |
| Durables | 239.4 | 242.9 | 243.4 | 252.1 | 258.5 | 277.7 | 282.8 | 298.6 | 244.5 | 279.4 |
| Motor vehicles and parts | 106.4 | 107.6 | 109.4 | 116.1 | 118.4 | 133.9 | 135.6 | 145.6 | 109.9 | 133.4 |
| Furniture and household equipment | 91.7 | 93.9 | 93.5 | 94.9 | 97.3 | 100.8 | 102.9 | 107.7 | 93.5 | 102.2 |
| Other | 41.3 | 41.4 | 40.5 | 41.1 | 42.8 | 43.0 | 44.3 | 45.3 | 41.1 | 43.8 |
| Services | 949.7 | 975.2 | 998.9 | 1,021.8 | 1,037.4 | 1,069.7 | 1,083.5 | 1,107.3 | 986.4 | 1,074.5 |
| Housing | 323.8 | 329.7 | 337.8 | 345.2 | 352.6 | 359.5 | 367.2 | 375.1 | 334.1 | 363.6 |
| Household operation | 140.2 | 144.6 | 145.2 | 147.1 | 145.9 | 155.4 | 155.8 | 157.9 | 144.3 | 153.8 |
| Transportation | 66.5 | 68.0 | 69.8 | 69.2 | 70.1 | 70.9 | 74.0 | 76.1 | 68.4 | 72.8 |
| Personal care | 18.1 | 18.2 | 18.4 | 18.6 | 18.5 | 18.7 | 18.7 | 18.7 | 18.3 | 18.6 |
| Medical care | 188.7 | 194.4 | 199.9 | 203.5 | 207.0 | 211.7 | 215.1 | 219.6 | 196.6 | 213.3 |
| Personal bus. service | 105.2 | 109.2 | 114.9 | 122.9 | 127.0 | 133.2 | 132.8 | 134.9 | 113.0 | 132.0 |
| Recreational services | 46.4 | 47.8 | 48.8 | 49.3 | 49.8 | 52.4 | 52.5 | 53.8 | 48.1 | 52.1 |
| Other | 60.8 | 63.3 | 64.1 | 66.0 | 66.5 | 67.9 | 67.4 | 71.2 | 63.6 | 68.3 |
| Savings | 130.8 | 127.1 | 123.0 | 120.8 | 121.7 | 91.5 | 115.8 | 125.6 | 125.4 | 113.6 |
| Other | 58.0 | 59.3 | 59.7 | 60.2 | 61.1 | 62.7 | 65.3 | 66.9 | 59.1 | 64.1 |
| Disposable personal income | 2,127.7 | 2,159.2 | 2,191.5 | 2,227.9 | 2,255.8 | 2,301.2 | 2,362.2 | 2,423.4 | 2,176.4 | 2,335.7 |

¹Reflects data as of March 21, 1984. ²Annual.

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Food Consumption and Nutritional Status of Low-Income Households

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In response to continued interest in determining the effectiveness of the food assistance programs, ERS researchers recently took a close look at the Food Stamp Program (FSP). This program supplied \$11.1 billion in stamps to approximately 21.6 million people in 1983—nearly 1 out of every 10 Americans.

ERS researchers found that the FSP increases food expenditures and improves the nutritional status of participant households. The magnitude of the FSP effects, however, depends on household characteristics.

The question of FSP effectiveness stems from two aspects of program operation. First, there is no stipulation on the types of foods that can be purchased with food stamps. They can be used to buy any domestic food or plants and seeds to grow food. Therefore, participants may not be choosing foods that enhance their nutritional status. Second, some households may use their stamps in place of income that would have been spent for food. The effect on food expenditures, then, may range from no increase to a rise by the full amount of program benefits.

Food Expenditure Patterns

As the first step in analyzing FSP effectiveness, ERS researchers considered differences in the amount spent for food at home by two categories of low-income households responding to the 1979-80 Nationwide Food Consumption Survey (NFCS)—those participating in the FSP and those eligible, but not participating. These two groups were further divided to determine differences in food spending patterns by race. Thus, four groups were considered: white FSP households; nonwhite FSP households; white eligible, but nonparticipating households; and nonwhite eligible, but nonparticipating households.

ERS researchers compared households within the same FSP status category and found that among participants, nonwhite households spent nearly \$26 a month, or 36 percent, more on meat and protein products, but \$9 a month, or 50 percent, less on dairy products than white house-

holds (figure 1). Monthly expenditures on fruits and vegetables differed by \$2.70, or 9 percent, with nonwhite FSP households spending more. White FSP households spent \$1.33, or 6 percent, more per month on breads and grains, and \$7.52, or 23 percent more on miscellaneous foods such as fats and oils, sugars and sweets, and nonalcoholic beverages.

Food expenditures also differed substantially by race among households eligible, but not participating in the FSP. Nonwhite households in this category spent about \$7, or 9 percent, more a month than their white counterparts on meat and protein products, but about \$11, or 62 percent, less on dairy products. Nonwhite households also spent about 47 percent, or \$15 a month, less than white eligible nonparticipating households on

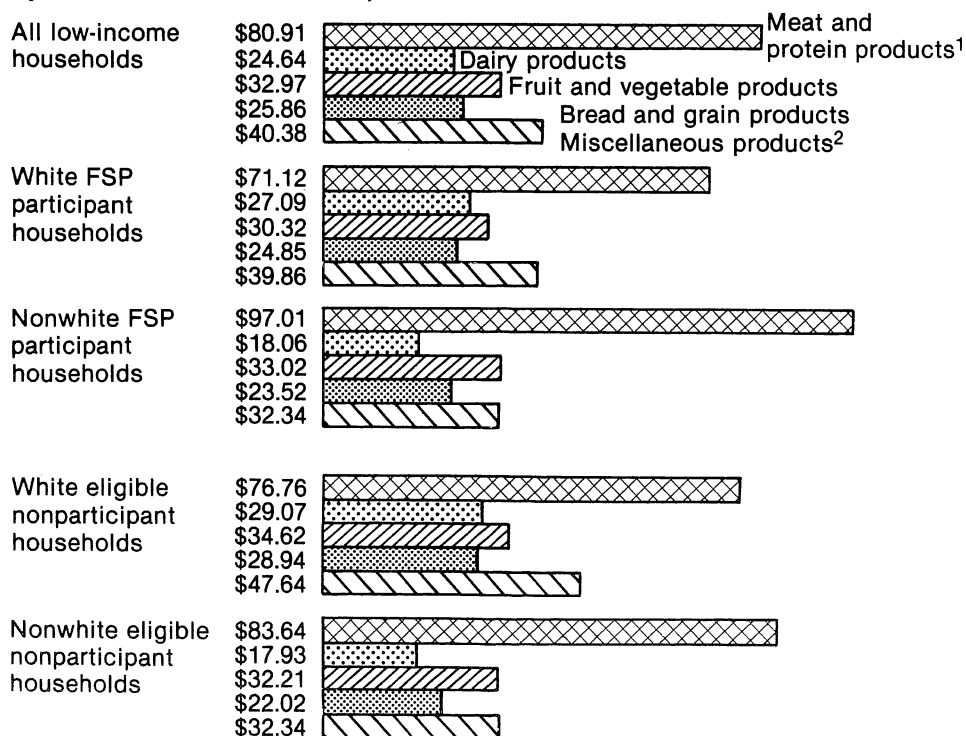
miscellaneous foods. Other differences in expenditures included \$2.41, or 7 percent, for fruits and vegetables, and \$6.92, or 31 percent, for bread and grains. White FSP households spent more for both groups of products.

The differences in food expenditures between whites and nonwhites may be due to food preferences associated with traditional eating habits. Furthermore, the high incidence of lactase deficiency among blacks, Native Americans, Asian Americans, and other nonwhites may explain their lower expenditures for dairy products. Lactase is an enzyme which is necessary to digest milk sugar.

The ERS researchers also compared households of the same race, but different FSP status. Among white households, eligible nonparticipants spent more

Figure 1

Average Monthly At-Home Food Group Expenditures by Low-Income Households, 1979-80



¹Includes poultry, fish, eggs, nuts, and peanut butter.

²Includes fats and oils, sugar and sweets, nonalcoholic beverages and condiments.

Source: Estimated from statistical analysis of the 1979-80 low-income supplement to the Nationwide Food Consumption Survey.

for each of the five major food groups (figure 1). The differences ranged from \$7.78 per month, or 20 percent, more for miscellaneous foods to \$1.98, or 7 percent, for dairy products. Among nonwhite households, participants spent more, for all categories except miscellaneous foods, where expenditures were the same. The largest difference—\$13.37 a month—was for meat and protein products. This amounted to a 16-percent difference between expenditures by nonwhite participant and nonparticipant households.

Some of the variation in food expenditures between participant and eligible nonparticipant households, especially among whites, may be due to differences in household size. White households participating in the FSP averaged 3.0 persons, compared with 3.7 persons in eligible, nonparticipating households. The number of persons in nonwhite households was about the same for participants and eligible nonparticipants, 3.6 persons and 3.5 persons, respectively.

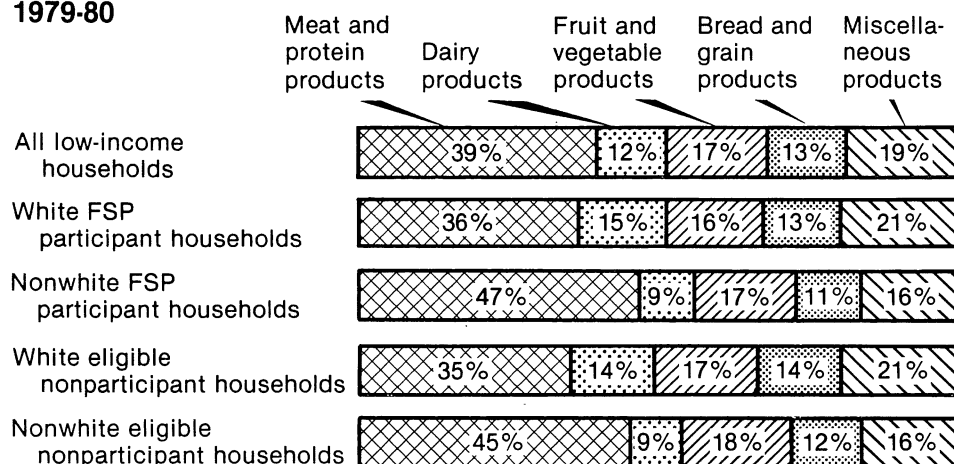
While the dollar value of food expenditures differed among the four categories of households, there are many similarities in the shares of the food dollar allocated to each food group. In general, within the same racial category, participating and eligible nonparticipating households allocated their food-at-home dollar in the same way (figure 2). However, white and nonwhite households, regardless of their food stamp status, allocated their food dollar differently. White households, on the average, spent a higher proportion of their food-at-home dollar on dairy products and miscellaneous foods, and a smaller proportion on meat and protein products, than nonwhite households (figure 2). Percentages of food-at-home expenditures allocated to fruits and vegetables and bread and grains were nearly identical.

Nutritional Status

To gauge the nutritional status of low-income households, ERS researchers used nutrient adequacy ratios (NARs) which express the nutritive value of food

Figure 2

Allocation of the At-Home Food Dollar by Low-Income Households, 1979-80



Source: Estimated from statistical analysis of the 1979-80 low-income supplement to the NFCS.

used in NFCS households as a percentage of the Recommended Dietary Allowances (RDAs). The RDAs are estimates of levels of nutrient intake for healthy people developed by the Food and Nutrition Board of the National Research Council. The Food and Nutrition Board periodically updates the RDAs to reflect the latest scientific evidence about nutritional intake. A NAR greater than 1.00 means that household members, on average, consumed more than the recommended amounts, while a ratio below 1.00 indicates that they consumed less than the RDAs.

Because large nutrient consumption by some households could distort the results, a cut-off point of twice the RDAs was adopted for the ERS analysis. Therefore, households whose consumption of any nutrient equaled or exceeded this amount were assigned a NAR of 2.00.

Furthermore, in measuring the effect of the FSP on nutritional status, the ERS study concentrated on five nutrients—vitamins A and C, riboflavin, calcium, and iron. Previous surveys, such as the 1968-70 Ten-State Nutrition Survey and the 1971-72 Health and Nutrition Examination Survey (HANES), indicated that these are the nutrients most likely to be

consumed in inadequate amounts by the low-income population.

The NARs for low-income households, on average, show that consumption of the five selected nutrients ranged from 74 percent above the RDAs for vitamin C to 16 percent above for calcium (table 1). The NARs for FSP and eligible nonparticipating households were about the same, except for calcium. Calcium consumption averaged 33 percent above the RDA for white FSP households, compared to 17 percent above for white households who were eligible, but not participating in the FSP. Milk products are a major source of calcium; therefore, it is not surprising that nonwhite households, on average, had much lower calcium adequacy ratios—only 6 percent above the RDA for participants and 1 percent above for eligible nonparticipants.

Average nutrient adequacy ratios can hide nutritional problems. For example, some households may fall below the RDAs, while others exceed them. Among low-income NFCS households, for instance, the proportion consuming below the RDAs ranged from 8 percent below for riboflavin to 40 percent below for calcium (table 2). Since the RDAs are guidelines and not requirements, con-

Table 1. Average Nutrient Adequacy Ratios¹

| Nutrient | Food stamp households | | | Eligible nonparticipant households | |
|------------|---------------------------|------------------|---------------------|------------------------------------|---------------------|
| | All low-income households | White households | Nonwhite households | White households | Nonwhite households |
| Vitamin A | 1.52 | 1.53 | 1.57 | 1.48 | 1.51 |
| Vitamin C | 1.74 | 1.75 | 1.77 | 1.71 | 1.78 |
| Riboflavin | 1.67 | 1.75 | 1.66 | 1.68 | 1.50 |
| Calcium | 1.16 | 1.33 | 1.06 | 1.17 | 1.01 |
| Iron | 1.42 | 1.49 | 1.41 | 1.39 | 1.37 |

¹ Nutrient adequacy ratio is the percentage of the Recommended Dietary Allowance (RDA) which is met by the household's consumption of a specified nutrient. For example, a household whose consumption of vitamin A is equal to the RDA for that nutrient would have a vitamin A adequacy ratio of 1.00. Because large consumption by some households could distort the results, the nutrient adequacy ratio for each nutrient was truncated at 2.00 for all households whose consumption exceeded twice the RDA.

Source: Estimated from statistical analysis of the 1979-80 low-income supplement to the Nationwide Food Consumption Survey.

sumption below them does not necessarily indicate an inadequate diet. However, the risk of having an inadequate diet does increase as consumption falls below recommended levels.

Eligible nonparticipants were more likely than FSP households to fall below 100 percent of the RDAs, with vitamin C the only exception. The largest differences occurred among nonwhite households where about 48 percent of the FSP households were below the RDAs for calcium, compared to about 61 percent for eligible nonparticipants. The results were similar for riboflavin, with about 9 percent of participants falling below the recommended levels, versus almost 21 percent of eligible non-FSP households.

While nutritional status of low-income households didn't vary substantially by race, a higher percentage of nonwhite households fell below 100 percent of the RDAs. The largest difference was again for calcium consumption, where about one-fourth to one-third of white households were below the RDAs, compared to half to three-fifths of nonwhite households.

The RDAs contain a safety margin to provide a buffer for physical and emotional stress that could affect the need for

nutrients. Therefore, two-thirds of the RDAs is often used to differentiate between adequate and poor diets.

Using this level, ERS researchers again examined the diets of households according to food stamp program participation and race. Though small, there were differences in the adequacy of the diets of food stamp households and eligible nonparticipant households. Approximately 8 percent of the participant households fell below 67 percent of the RDAs for vitamin A, compared to 7 percent of eligible nonparticipant households. Similarly, 8 percent of the participant and 6 percent of the eligible nonparticipant households fell below 67 percent of the RDA for iron. About 2 percent of both types of households were below the 67 percent level for riboflavin.

The opposite pattern emerged for calcium and vitamin C, with a greater proportion of eligible nonparticipant households consuming inadequate levels. About 19 percent of these households consumed less than 67 percent of the RDA for calcium; 6 percent were below for vitamin C. The corresponding numbers for participant households were 17 and 4 percent.

Among white households, eligible nonparticipants were more likely to have poor diets based on their at-home consumption of the five nutrients included in the ERS study. The only exception was iron, where 8 percent of the participant house-

A Note on the Data

The ERS study is based on analysis of data from the 1979-80 supplement to the Nationwide Food Consumption Survey (NFCS). From November 1979 through May 1980, about 3,000 households either participating or eligible to participate in the FSP were interviewed about the kinds, quantities, and costs of food and beverages used during the week prior to the interview. These households were representative of low-income households in the 48 contiguous States.

The NFCS measures only food consumed at home, necessitating several adjustments in the data to make valid comparisons across households. First, the nutrient levels of NFCS households, calculated by nutritionists at USDA's Human Nutrition Information Service (HNIS), were based on the edible portion of food from the at-home food supply. Then, in order to compare the nutrient levels to the RDAs, an adjustment was made for the number of meals eaten away from home. This was necessary because the RDAs are based on total food consumption. The nutrient adequacy ratios developed for the ERS study also reflected adjustments for differences in composition of households, since the RDAs vary according to age and sex.

Finally, although nutritionists adjusted for vitamins lost during cooking, the nutrient levels for many households may still be somewhat overstated since no allowance was made in the NFCS for food waste. The nutrient content of diets, then, includes usable nutrients in discarded foods, such as fat trimmed from meat, as well as leftovers fed to animals.



Table 2. Proportion of Low-Income Households with Nutrient Levels Below the Recommended Dietary Allowances

| Nutrient | Food stamp households | | | Eligible nonparticipant households | |
|----------------|---------------------------|------------------|---------------------|------------------------------------|---------------------|
| | All low-income households | White households | Nonwhite households | White households | Nonwhite households |
| Percent | | | | | |
| Vitamin A | | | | | |
| Below 100% RDA | 20.14 | 20.33 | 15.44 | 21.83 | 22.73 |
| Below 67% RDA | 7.64 | 7.62 | 8.52 | 8.65 | 5.00 |
| Vitamin C | | | | | |
| Below 100% RDA | 10.15 | 10.76 | 9.94 | 9.90 | 9.73 |
| Below 67% RDA | 4.95 | 3.90 | 4.47 | 6.36 | 3.47 |
| Riboflavin | | | | | |
| Below 100% RDA | 8.05 | 4.57 | 8.70 | 5.16 | 20.62 |
| Below 67% RDA | 2.02 | 0.89 | 3.86 | 1.25 | 3.42 |
| Calcium | | | | | |
| Below 100% RDA | 40.31 | 27.43 | 48.15 | 37.77 | 60.69 |
| Below 67% RDA | 17.93 | 11.96 | 21.79 | 16.16 | 28.10 |
| Iron | | | | | |
| Below 100% RDA | 20.62 | 17.67 | 25.71 | 18.09 | 26.90 |
| Below 67% RDA | 6.97 | 7.89 | 8.02 | 4.36 | 10.89 |

Source: Estimated from statistical analysis of the 1979-80 low-income supplement to the Nationwide Food Consumption Survey.

holds fell below two-thirds of the RDAs, compared with 4 percent of the eligible nonparticipant households.

Nonwhite participant households were more likely than their eligible, but nonparticipant counterparts to fall below 67 percent of the RDAs for vitamins A and C, and riboflavin. Conversely, nonwhite eligible participants were more likely to have calcium and iron adequacy ratios below 67 percent of the RDAs.

Impact of the Food Stamp Program

The preceding comparisons, while highlighting differences in food expenditures and nutritional status of food stamp participants and eligible nonparticipants, do not explain the effects of the FSP. Therefore, ERS researchers developed regression models to estimate the impact of the FSP on food expenditures and nutrient levels. These models controlled for differences in income, region, urbanization, household characteristics, and other factors that influence food consumption.

The results show that participation in the FSP tends to significantly increase total at-home food expenditures, and at-home expenditures for meats and protein products, and fruits and vegetables. Not surprisingly, the study also found that the FSP is more effective in raising food expenditures for some groups of households than others. As household size increases, for example, a greater proportion of the discretionary income freed by participation in the FSP is spent to purchase additional food. This effect was significant for expenditures for all food-at-home, as well as for at-home dairy, bread and grain, and miscellaneous foods. For example, the results indicate that given a \$1 increase in weekly food stamps, a white, three-member household in the central city would increase its at-home food purchases by 28 cents, while a similar household with six members would increase food purchases by 36 cents. Similarly, for a three-person household, 2 cents of each \$1 increase in food stamps would be spent for additional dairy purchases, 2 cents for more bread and grain purchases, and 4 cents for additional miscellaneous food purchases. These results are cited

because they were statistically significant. Corresponding numbers for a six-person household are 4 cents for dairy products, 4 cents for bread and grain products, and 6 cents for miscellaneous foods. These purchases would not have been made in the absence of the FSP. In calculating these impacts, it was assumed that these households had a weekly income of \$97 and received \$14 a week in food stamps. These are, in fact, the average values for the NFCS respondents.

Food stamps had a significantly greater impact on spending for dairy products and miscellaneous foods by households at the lowest income levels, but lost effectiveness with increasing income. In fact, households with weekly incomes above \$187 spent no additional food stamp dollars for dairy products or miscellaneous foods.

The ERS findings suggest that food stamps are significantly more effective in raising total at-home food expenditures and those for dairy products, fruits and vegetables, and miscellaneous foods by white than nonwhite households. Further, FSP participation has a stronger impact on total at-home food expenditures and at-home food purchases of meat and protein products, fruits and vegetables, and bread and grains for central city households than for suburban or nonmetropolitan households.

Participation in the FSP resulted in a small, but statistically significant, improvement in the nutrient adequacy ratios of the five selected nutrients. For example, a \$10-a-week increase in food stamps, on average, would increase iron adequacy by 0.07. For every additional \$10 increase in food stamps per week, calcium adequacy would rise by 0.05, riboflavin and vitamin A adequacy by 0.04, and vitamin C adequacy by 0.03.

The ERS study found that food stamps were most effective in improving nutrient adequacy of small households. Moreover, food stamps were significantly more effective at very low household income levels in improving nutrient adequacy ratios

for vitamin A, riboflavin, and iron. The impacts of the FSP on nutrient adequacy ratios did not vary significantly by race or urbanization.

The ERS study suggests that as food assistance policy is developed, it is important for policymakers and food program administrators to be aware of the impact of the FSP on different segments of the low-income population. For example, the Omnibus Budget Reconciliation Act of 1981 limited FSP eligibility to households whose gross income is at or below 130 percent of the poverty level established by the Office of Management and Budget (OMB), eliminating some higher income households from the FSP. The results of the ERS study, then, would suggest that, because households with relatively high incomes benefit least from the FSP, imposing this new limit likely raised the overall effectiveness of the program in terms of raising food expenditures and nutrient levels.

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Food and Nutrition Legislation

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Food Stamp Program

H.R. 5054—Rep. Danny Burton (IN)

Would establish a mandatory workfare program applicable to households participating in the Food Stamp Program.

S. 2431—Sen. Jesse Helms (NC)

Would add Food Stamp recipients to the categories of individuals who may be employed by private enterprise under the Targeted Jobs Tax Credit Program of the Internal Revenue code. Companies who hire individuals that participate in Federal assistance programs such as Aid to Families with Dependent Children are allowed a tax credit for a portion of the salary of each such individual under the targeted jobs program.

Food Assistance

H.R. 5151—Rep. Leon Panetta (CA)

Called the "Hunger Relief Act of 1984," this bill is designed to strengthen Federal nutrition programs. It would allow individuals without a fixed address to qualify for food stamps; increase benefits according to changes in the Thrifty Food Plan on a quarterly rather than on an annual basis; make any person receiving specific Social Security supplemental benefits or aid to the aged, blind, or disabled eligible for food stamps; provide deductions for tuition, a housing allowance, or dependent care when such care enables a household member to accept or continue employment; establish a Food Stamp Disaster Task Force to assist States in implementing and operating the disaster program and the regular Food Stamp Program in the disaster area; provide half the cost to States of a job search training program; and provide \$11.7 million to cover 100 percent of the food assistance costs and 50 percent of the administrative costs of a pilot food stamp project for rural areas of Alaska.

Other provisions of the bill would enable local agencies to administer the commodity supplemental food program; institute a continuous food consumption and expenditure survey of low-income individuals and a program to provide financial and technical assistance to States to

enhance nutrition and consumer education programs for low-income persons. Also, the bill would lower the price of school lunches; increase by 6 cents per meal the Federal payment to schools for breakfast; add Federal payments for one meal and one snack to the Child Care Food Program to total three meals and two supplements daily; raise authorizations for nutrition education from \$5 million to \$7.5 million for 1984; and increase appropriations for group feeding and home-delivered meals under the Older Americans Act of 1965.

Child Nutrition Programs

H.R. 4911—Rep. Stephen Solarz (NY)

Would allocate \$15 million annually for food service equipment assistance for the school lunch program. Federal aid for equipment expenses was repealed under the Omnibus Budget Reconciliation Act of 1981.

H. Res. 478—Rep. David Bonior (MI)

Provides for the consideration of H.R. 7, which extends through fiscal year 1988, five school feeding programs that expire on September 30, 1984. H.R. 7 would raise the eligibility for reduced price school lunches from the current 185 percent of the Office of Management and Budget's (OMB) Federal poverty guidelines to 195 percent. The bill also contains many of the provisions of H.R. 5151, including allowing an additional 6 cents per meal to improve the nutritional quality of the breakfast program; lowering the price of school lunches; adding one meal and one snack to the child care food program; and increasing the authorization for nutrition education. In addition, H.R. 7 would allow a medical hardship for unusually high medical payments for families applying for free and reduced price school lunches; allow the special milk program for kindergarten programs; and allow more private schools to participate in the school lunch program by raising the tuition limitation to \$2,500. Currently, schools with an annual tuition of \$1,500 or more are not eligible to receive Federal assistance for their school lunch program.

Food and Nutrition Actions by USDA

Tom Fulton
(202) 447-4943

USDA regularly proposes and implements operational and regulatory changes that affect the status of food and nutrition in the United States. Here are some recent actions.

Agricultural Programs

- On March 26, USDA announced details of the national dairy products promotion, research, and nutrition education program mandated by the Dairy and Tobacco Adjustment Act of 1983 to help alleviate the surplus production of milk in the United States. To fund the program, the act provides for the collection of 15 cents per hundred pounds (cwt) on all milk marketed by dairy farmers in the 48 States. The program is in effect through September 1985. Extension of the program will depend upon a national referendum of dairy farmers to be conducted by USDA during August-September 1985.

Food Safety and Quality

- On March 2, the Environmental Protection Agency (EPA) announced that it was proposing to ban the use of ethylene dibromide (EDB) on citrus fruits and papayas by September 1. Several alternative treatments have been discussed, including gamma irradiation, certification of fruit fly free zones, heat treatment for papayas, fumigation with methyl bromide and phosphine gas, and extended cold storage. However, all alternative treatment methods for citrus imports need the approval of USDA as being effective in preventing importation of various species of fruit flies before they can be implemented.

- Since March 12, USDA has permitted poultry processors to reduce costs by reusing water for chilling poultry carcasses after filtering or treatment. Under the new regulation, the amount required to replace the fresh water will be based on the quality of the reconditioned water. The final rule does not specify a required method of water treatment, rather processors will be required to submit their proposed method to USDA for approval.

• On March 21, USDA announced that shippers treating cattle for scabies prior to moving them across State lines may now use an injection of ivermectin rather than dipping the entire animal. Under the terms of the Food and Drug Administration's approval, such animals must not be slaughtered until 35 days after treatment.

Food Imports

• On March 15, USDA announced that the quota for sugar imports from September 26, 1983 to September 30,

1984 was being raised from 2.95 to 3.05 million short tons, raw value.

School Lunch and Food Stamps

• USDA, on April 2, proposed methods of increasing accountability among those who apply for school lunch benefits. Beginning in September, a new application form will be used which asks for a listing of the amount and source of income of all adults in the applicant's family.

• On April 2, USDA signed agreements with North Carolina, Vermont,

and Maryland to test proposed Food Stamp Program changes. North Carolina will test a new computer-assisted interview for persons applying for food stamps. In Vermont, persons determining an applicant's eligibility will be trained to detect fraud and errors through improved interviewing skills. Maryland will use brochures and videotapes designed by advertisers to help let food stamp applicants know what information they must report to caseworkers. Field testing is expected to begin this fall, with final reports due to USDA a year later.

ELECTRONIC INFORMATION

Economic Outlook and Situation report summaries are available to subscribers of electronic mail systems and data systems.

The summaries highlight the latest USDA supply/demand and price forecasts for U.S. and world crops and livestock, and prospects for exports and the agricultural economy.

The summaries are on line by 3:30 p.m., Washington, D.C. time, on the dates listed (release dates are subject to change). Full reports are on the electronic mail systems in a few days.

For information on providers of this service, call (202) 382-9759, or write EMS Information, USDA, Room 440 GH1, Washington, D.C. 20250.

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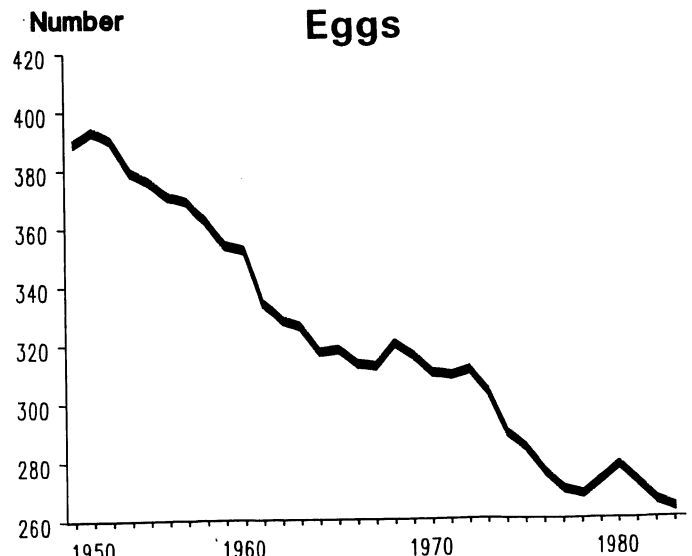
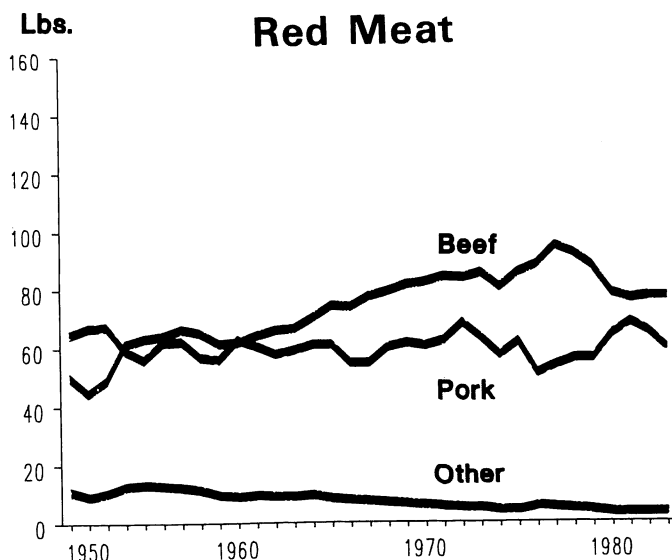
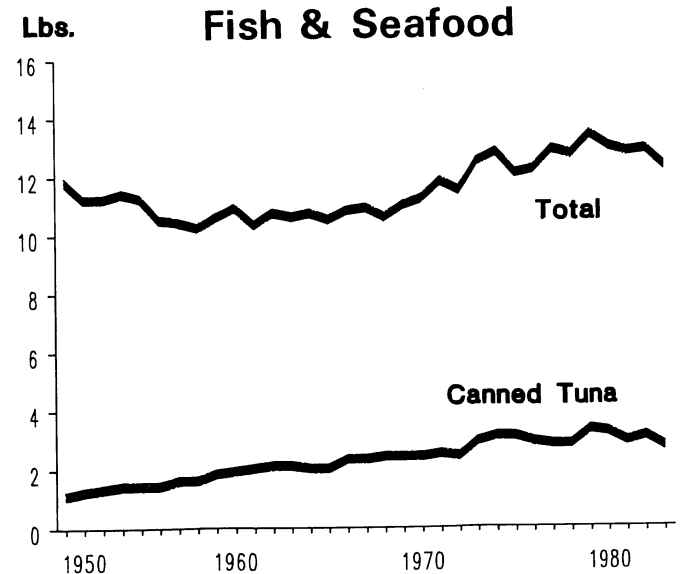
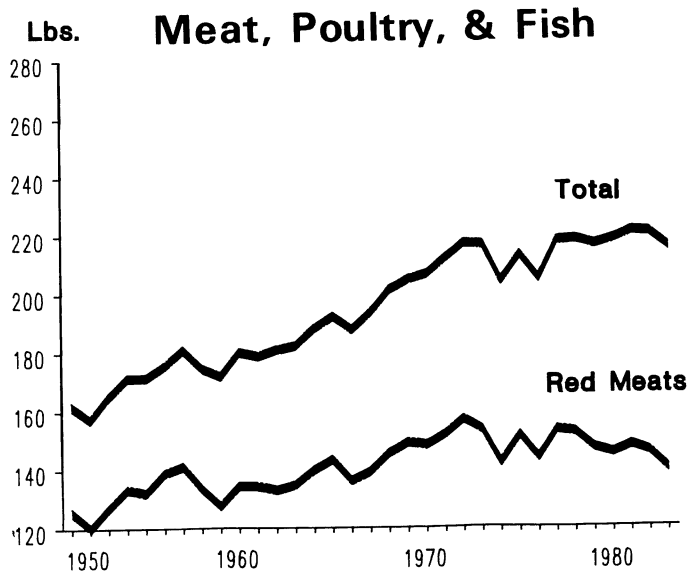
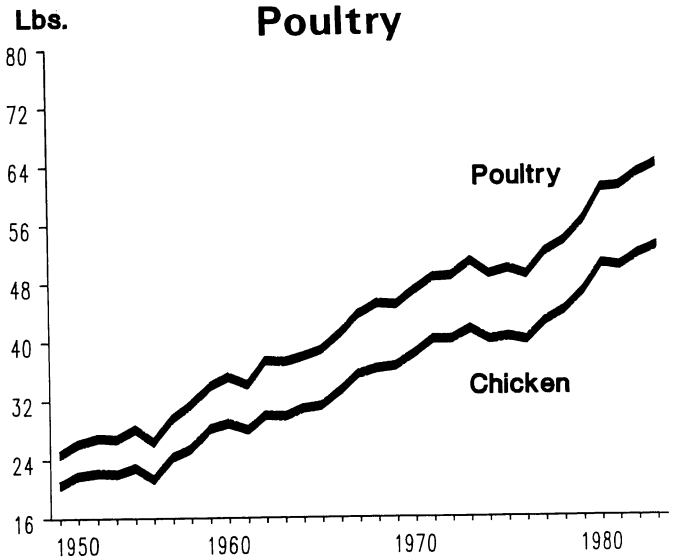
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U.S. Per Capita Consumption

Total consumption of meat, poultry, and fish has increased 33 percent since 1950—from an average of 162 pounds to nearly 216 pounds in 1982. Most of this growth occurred prior to 1970, when consumption began to level off.

Although total consumption of meat, poultry, and fish has varied no more than 6 pounds per capita since 1970, the mix has changed. For example, we ate about 63 pounds of chicken and turkey each year in 1980-82, compared to only about 50 pounds during the first 3 years of the 1970's. Beef and veal consumption fell from 86.4 pounds to 78.6 pounds per person during the decade. Pork consumption changed little—dipping from an average of 64.5 pounds in 1970-72 to 64.1 pounds in 1980-82. Fish consumption began climbing, though slowly, in the 1970's. By 1982, it totaled 12.3 pounds per person, compared to 11.8 pounds in 1970.



Food Prices

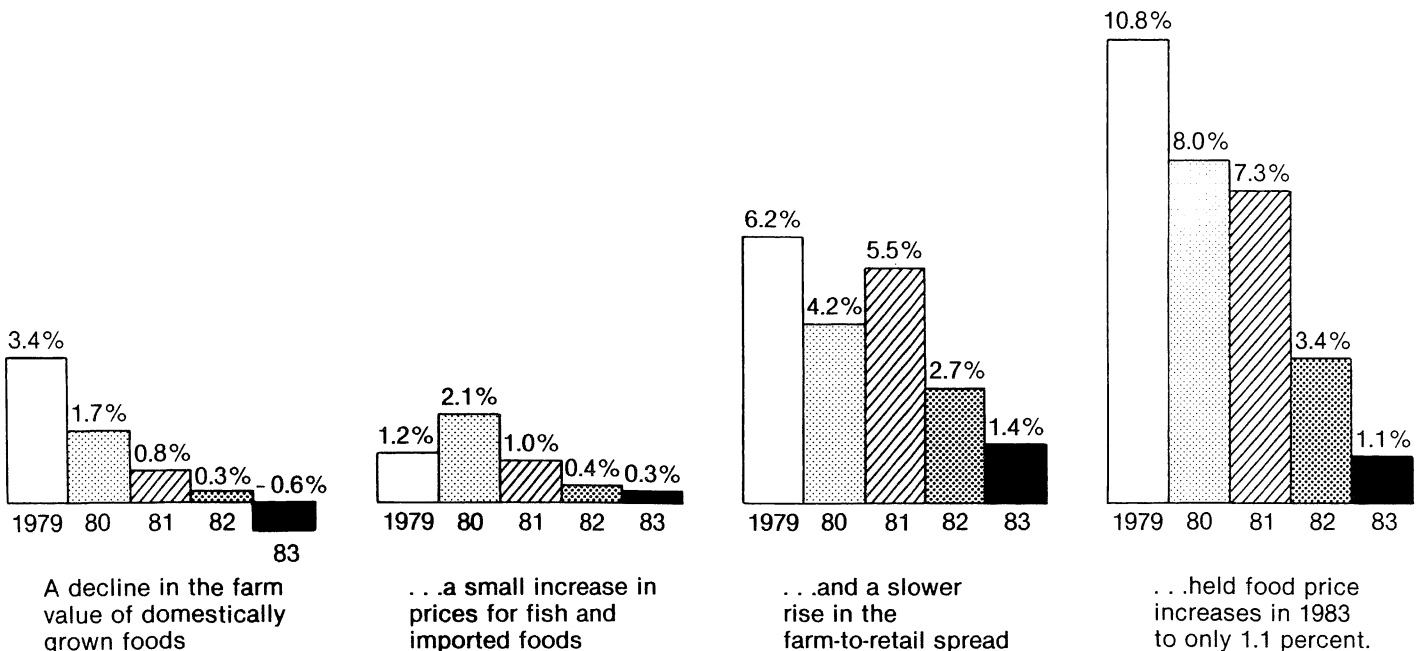
Last year, a combination of greater livestock production, limited increases in food processing and distribution costs, and weak consumer demand led to the smallest increase in retail food prices in 16 years. While foodstore prices inched up only 1.1 percent in 1983, retail prices for food at home and away rose 2.1 percent. Greater increases, however, are expected in 1984. Farm prices in March were up 9 percent over a year earlier; producer prices of foods, 6 percent; and consumer prices of all foods, 4 percent.

Price increases don't affect all foods the same. Retail prices for beef, for example, rose 2.6 percent from March 1983 to March 1984, while pork and other meat prices dropped 8.3 and 1.7 percent, respectively. Other retail price increases over the 12 months from March 1983: 35.5 percent for eggs, 15 percent for poultry, and 13 percent for fruits and vegetables. Dairy product prices remained virtually unchanged, and fish and seafood prices rose a modest 1.4 percent.

Changes in Selected Retail Food Prices

| Item | 1984 Feb-Mar | 83-84 Mar-Mar |
|------------------------|-----------------|------------------|
| | Percent | |
| All food | 0.0 | 4.0 |
| Food away from home | 0.4 | 4.2 |
| Food at home | -0.2 | 4.0 |
| Meat, poultry, fish | | |
| Meats | -0.4 | -1.5 |
| Beef and veal | -0.4 | 2.6 |
| Pork | -0.8 | -8.3 |
| Other | 0.0 | -1.7 |
| Poultry | -1.0 | 15.2 |
| Fish and seafood | -0.2 | 1.4 |
| Eggs | -12.2 | 35.5 |
| Dairy products | 0.0 | 0.5 |
| Fats and oils | -0.1 | 8.6 |
| Fruits and vegetables | 0.7 | 12.7 |
| Sugar and sweeteners | 0.9 | 3.2 |
| Bakery and cereal | 0.4 | 4.0 |
| Nonalcoholic beverages | 0.4 | 2.5 |
| Other prepared foods | 0.2 | 2.2 |

Why the Pace of Foodstore Prices Slowed



Income and Expenditures

As the unemployment rate dropped 2.5 percent from February 1983 to the same month in 1984, hourly manufacturing earnings rose 4 percent, reflecting the strength of the economic recovery as it moved into 1984.

In 1983, consumer expenditures for food rose 5 percent to \$312 billion. Of that \$84 billion went to farmers, an increase of 0.6 percent from 1982. The marketing bill—those costs other than the farm value—rose 6.5 percent over the same period. Out of each consumer food dollar, the share for labor and advertising increased, while the portion to farmers declined.

Per capita consumption climbed 10 pounds in 1983 to 1,395 pounds. Americans consumed more of every food group, except vegetables.

Per Capita Consumption and Expenditures For Selected Foods, 1982-1983

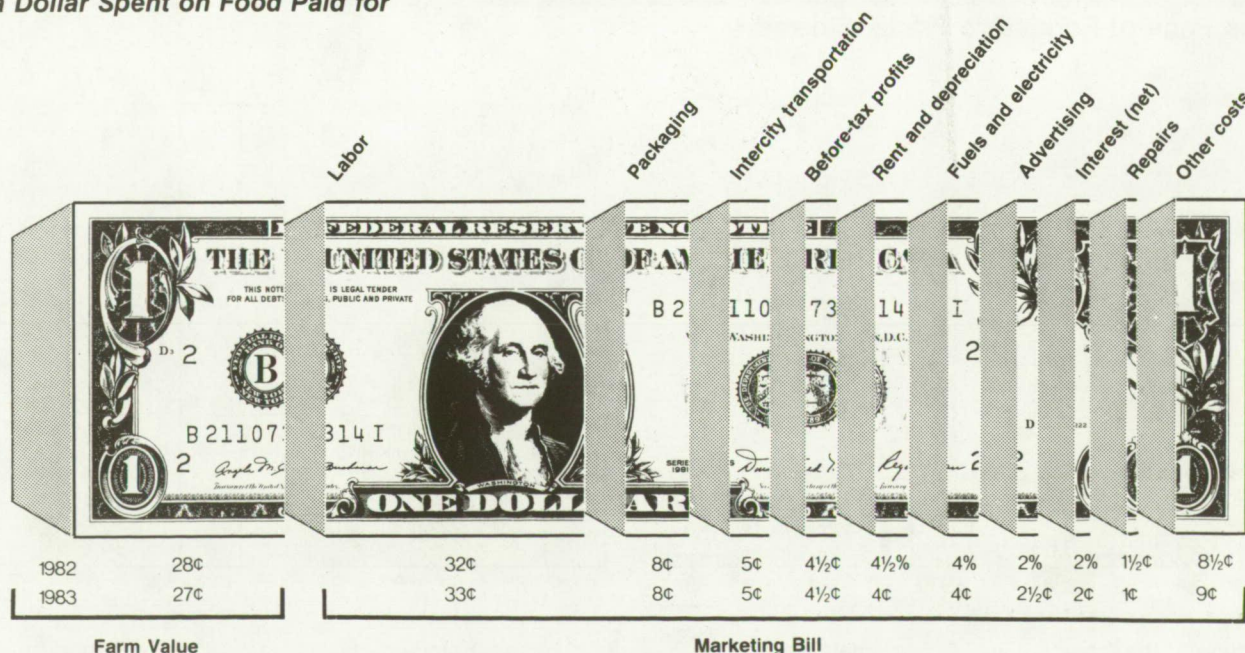
| Item | 1982 | | 1983 ¹ | |
|-----------------------------------|---------------------------|--------|---------------------------|--------|
| | Expenditures ² | | Expenditures ² | |
| | dollars | pounds | dollars | pounds |
| Animal products | 429.47 | 573 | 435.25 | 582 |
| Beef, veal | 120.75 | 79 | 129.75 | 80 |
| Pork | 111.16 | 59 | 115.44 | 62 |
| Poultry | 40.15 | 64 | 37.52 | 66 |
| Eggs | 20.54 | 33 | 19.00 | 34 |
| Dairy products | 125.07 | 302 | 121.01 | 305 |
| Crop products | 406.22 | 814 | 417.38 | 819 |
| Fruits | 78.40 | 156 | 74.19 | 164 |
| Vegetables | 155.20 | 286 | 147.11 | 280 |
| Flour, cereal, and grain products | 141.46 | 150 | 166.38 | 151 |
| All foods ⁴ | 1,726.50 | 1385 | 1,819.18 | 1395 |

¹Preliminary. ²Expenditures for food consumed at home only. ³Total estimated consumption at all locations. ⁴Expenditures and consumption data are for all food consumed at all locations.

Hourly Earnings Keep Pace With Increases in Employment

| Year | Total employed | Unemployment rate | Hourly mfg earnings | Population | |
|-----------------|----------------|-------------------|---------------------|------------|----------|
| | millions | percent | dollars | Total | Civilian |
| 1981 | 100.4 | 7.5 | 7.99 | 229.9 | 227.7 |
| 1982 | 99.5 | 9.5 | 8.50 | 232.1 | 229.9 |
| 1983 | 100.8 | 9.5 | 8.84 | 234.2 | 232.0 |
| 1984 | | | | | |
| Jan. | 103.2 | 7.9 | 9.09 | | |
| Feb. | 103.9 | 7.5 | 9.09 | | |
| Percent changes | | | | | |
| Feb. 1983 - | | | | | |
| Feb. 1984 | 4.7 | -2.5 | 3.9 | | |

What a Dollar Spent on Food Paid for



Includes food at home and away from home. Other costs include property taxes and insurance, accounting and professional services, promotion, bad debts, and many miscellaneous items.

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