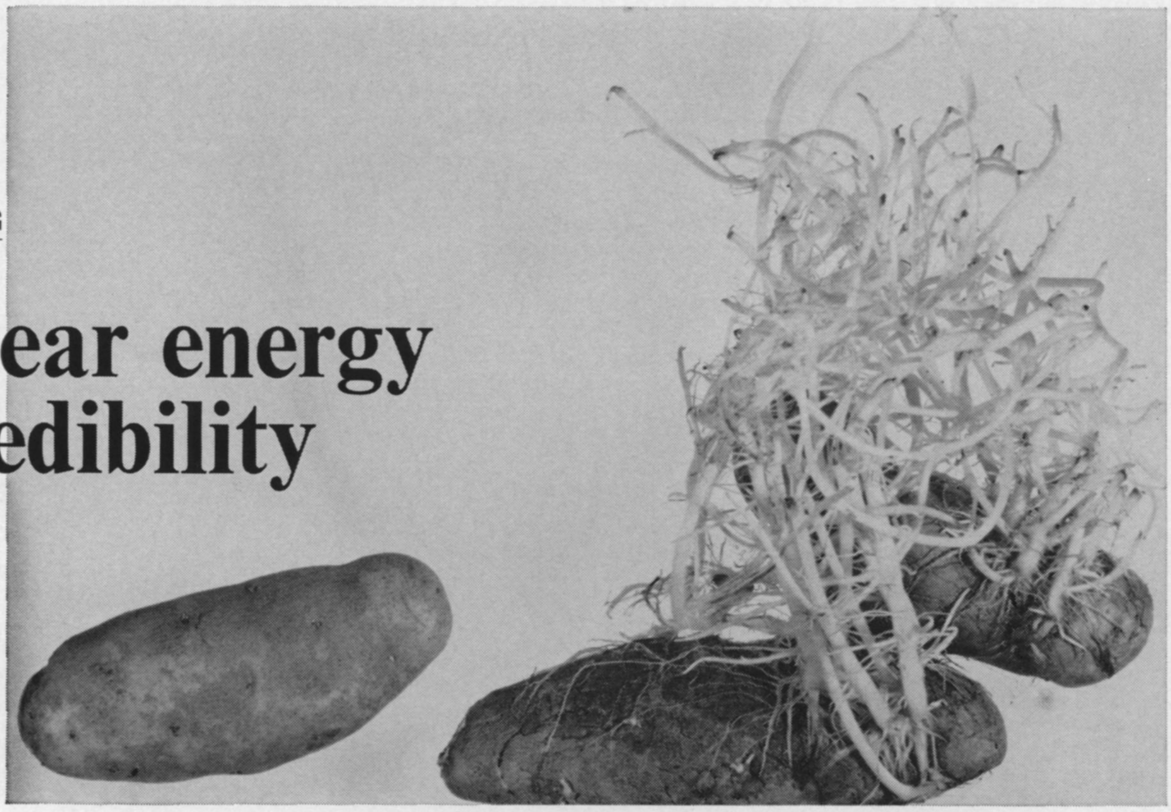
Nuclear energy and edibility



Potato sprouting is inhibited by radiation: All three potatoes are the same age.

Food irradiation is a process striving to be commercialized, but it still must prove itself

by Edward Gross

In the U.S. spoilage in fruits and vegetables alone during transit and in stores amounts to $190 million annually. Poultry and poultry product losses during marketing and processing come to $78 million. Insects and other spoilage agents attack items such as cereals, fruits and vegetables and dairy products, doing damage to the sum of $1.04 billion.

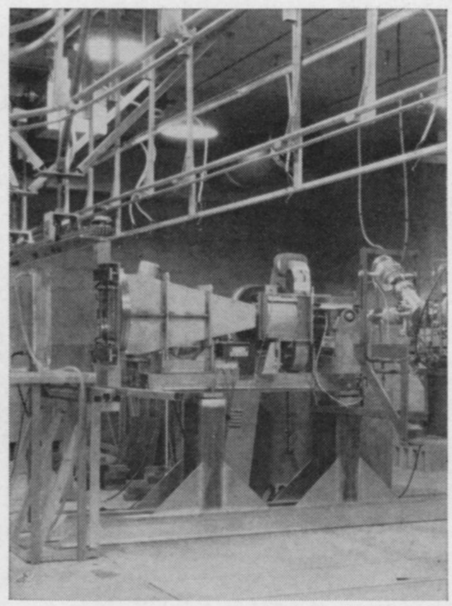
It has long been hoped that irradiation would provide an answer to the problem of food conservation.

Nearly 15 years ago, a food journal wrote that the use of radiation to preserve food was still far from imminent, and probably would not be introduced commercially for at least five years. That same statement still holds true today; food irradiation, or cold sterilization as it is also termed because it employs little heat, has moved only slightly off dead center toward commercialization.

Some progress has been made in the last 15 years. White potatoes, wheat and wheat flour were approved by the Food and Drug Administration. But irradiation of more exotic—and more valuable—foods such as strawberries, while promising, has not yet gained approval. The only meat to be approved was bacon, and that approval was later withdrawn.

The most severe setback came last summer, when the Food and Drug Administration withheld approval of irradiated ham for military consumption, not because anything was proved wrong with the food but because the evidence presented by the Army, the chief exponent of the process in the United States, did not demonstrate safety to FDA satisfaction; all the pro and con evidence against food irradiation, according to FDA standards, is inconclusive.

Over the past 15 years, the evidence has in fact been contradictory: Japanese scientists who ate the raw meat of fish contaminated by a United States H-bomb test reported no adverse effects. Two scientists for the U.S. Atomic Energy Commission found no significant differences between irradiated meat from cows and sheep and nonirradiated meat. Researchers at places such as the University of Wisconsin and Oregon State College reported irradiated foods wholesome and safe. A private testing company in New Jersey found no adverse effects on adult dogs fed irradiated food; their puppies were even normal and healthy. The Army, based on studies of nine species of tumor-prone mice, concluded that irradiated foods are no more carcinogenic than nonirradiated foods. Twenty-one foods, meats, fruits and vegetables, irradiated and fed to thousands of rats and



Army Radiation Lab

Accelerator is source of electrons.

. . . food irradiation

mice, hundreds of dogs and more than a score of monkeys for two years, were found to be as wholesome as nonirradiated food.

But the FDA also had before it the results of additional animal and food studies in a score of university and Government laboratories. These studies indicated, for example, that rats fed irradiated food had fewer offspring and more stillbirths, evinced a high mortality rate, and developed cataracts and malignant tumors, and that dogs lost in body weight, had fewer progeny and produced fewer red blood cells and thus had less hemoglobin to carry oxygen.

There were indications that the irradiated food produced antinutrient agents that caused harmful changes in the nutritional quality of the nonirradiated food when the two foods were mixed. Other studies suggest the possibility that irradiation could alter copper-containing minerals so the body couldn't use them, thereby creating a deficiency disease, which in mice can show up as heart lesions.

So when it came time for the Army to petition the Food and Drug Administration to serve irradiated ham to troops, the FDA not only refused to accept it but set the commercialization of food irradiation back by going back and withdrawing the approval it had previously given to irradiated bacon. The Army was extremely disappointed; the process could eventually eliminate many of the supply problems of refrigerating and storing food for troops.

Some fresh fruits and vegetables do not respond well to irradiation, which causes changes in their texture or the products show no benefit. On the positive side, though, some fruits do respond well, and irradiation has been shown to inhibit sprout growth in potatoes, delay the ripening of and therefore extend the shelf life of tomatoes and bananas, and change the metabolism of apples, thus reducing their rate of softening. One of the most difficult foods to irradiate from the standpoint of flavor is milk, which gives off an offensive odor on irradiation.

Apart from safety, the problem is that any change in the odor, color or flavor of a food is a chemical change which the irradiation triggers. Irradiation involves bombarding food molecules with relatively high amounts of energy—high for the molecules at any rate. This energy causes changes to occur in molecular structure which show up as changes in odor, flavor, color or texture. The energy also enables the food to react with other substances, such as air, to form new products.

Two types of ionizing radiation are used in food irradiation: gamma rays and electrons. Gamma rays have an edge because electrons lack their penetrating power; the depth of penetration with a 10 million-volt electron generator is only two inches. There are several potential sources for gamma rays and electrons.

The waste products of nuclear reactor fuels are a good source for gamma rays. Spent fuel elements containing gamma-emitting fission products can be used, or the fission products can be separated and purified. Cesium 137, for example, is already being isolated in one Atomic Energy Commission waste removal plant.

Radioactive isotopes can also be artificially produced by exposing certain substances in a reactor. Cobalt 60 is produced this way. Recent technology has made it possible to irradiate large quantities of food economically with this isotope.

For the generation of electrons, the most preferred source is the linear accelerator because it employs high-frequency power instead of the high voltage required by other electron sources such as Van de Graaff accelerators. The lower voltage means fewer insulation problems.

Despite the setbacks, these technologies are making progress. Both the Army and the AEC are optimistic over the future of food irradiation. An AEC spokesman says that he is certain that full-scale commercialization of food irradiation will occur for those foods best suited to it technically and economically.

It may not gain real impetus unless the food industries themselves take an active interest. Representative Craig Hosmer (R-Calif.), a member of the Joint Congressional Committee on Atomic Energy, finds that the food industry, conservative in nature and lacking interest in research, is not greatly interested in the process. Neither is Rep. Hosmer, who has half seriously suggested a five-year moratorium on the process, a delay which the AEC says would hold up worldwide food irradiation if not permanently then for many years to come.

The FDA has adopted a wait-and-see attitude on the future prospects of food irradiation. It concedes, however, that "at the moment prospects don't look too bright."

The door is still open at FDA if anyone can come up with an irradiation procedure that produces a commodity that is "wholesome, shows advantages in use and meets the requirements of food additive regulations." So far, that seems not to have been the case. ◇