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Chapter 9

Food

MINIMUM NEEDS

The average American is accustomed to eating regularly and abundantly. He may not realize that for most people food would not be essential for survival during the first two or three weeks following a nuclear attack. Exceptions would be infants, small children, and the aged and sick, some of whom might die within a week without proper nourishment. Other things are more important for short-term survival: adequate shelter against the dangers from blast and fallout, an adequate supply of air, and enough water.

The average American also may not realize that small daily amounts of a few unprocessed staple foods would enable him to survive for many months, or even for years. A healthy person--if he is determined to live and if he learns how to prepare and use whole-grain wheat or corn--can maintain his health for several months. If beans are also available and are substituted for some of the grain, the ration would be improved and could maintain health for many months.

The nutritional information given in this chapter is taken from a July, 1979 publication, *Maintaining Nutritional Adequacy During a Prolonged Food Crisis*.²⁶ This book brings together from worldwide sources the nutritional facts needed to help unprepared people use unaccustomed foods advantageously during the prolonged crisis that would follow a heavy nuclear attack. The practical know-how which will be given in this chapter regarding the expedient processing and cooking of basic grains and beans is based on old ways which are mostly unknown to modern Americans. These methods have been improved and field-tested by civil defense researchers at Oak Ridge National Laboratory.

LOSS OF HIGH-PROTEIN ANIMAL FOODS

A massive nuclear attack would eliminate the luxurious, complicated American system of food production, processing, and distribution. Extensive, heavy fallout and the inability of farmers to feed their animals would kill most of the cattle, hogs, and chickens that are the basis of our high-protein diet. The livestock most likely to survive despite their owners' inability to care for them would be cattle on pasture. However, these grazing animals would swallow large numbers of fallout particles along with grass, and many would drink contaminated water. Their digestive tracts would suffer severe radiation damage.²⁷ Also, they would suffer radiation burns from fallout particles. Thus in an outdoor area where the total dose from gamma radiation emitted within a few days from fallout particles on the ground might be only 150 R, most grazing animals probably would be killed by the combined effects of external gamma-ray radiation, beta burns, and internal radiation.²⁷

PRECAUTIONS WHEN EATING MEAT

In areas where the fallout would not be enough to sicken animals, their meat would be safe food. In fallout areas, however, animals that have eaten or drunk fallout-contaminated food or water will have concentrated radioactive atoms and molecules in their internal organs. The thyroid gland, kidneys, and liver especially should not be eaten.

If an animal appears to be sick, it should not be eaten. The animal might be suffering from a sickening or fatal radiation dose and might have developed a bacterial infection as a result of this dose. Meat contaminated with the toxins produced by some kinds of bacteria could cause severe illness or death if eaten, even if thoroughly cooked.

Under crisis conditions, all meat should be cooked until it is extremely well done—cooked long past the time when it loses the last of its pink color. To be sure that the center of each piece of meat is raised to boiling temperature, the meat should be cut into pieces that are less than 1/2-inch thick before cooking. This precaution also reduces cooking time and saves fuel.

SURVIVAL OF BREEDING STOCK

Extensive areas of the United States would not receive fallout heavy enough to kill grazing animals. The millions of surviving animals would provide some food and the fertile breeding stock needed for national recovery. The loss of fertility caused by severe radiation doses is rarely permanent. Extensive experiments with animals have shown that the offspring of severely irradiated animals are healthy and fertile.²⁷

LIVING ON BASIC PLANT FOODS

Even if almost all food-producing animals were lost, most surviving Americans should be able to live on the foods that enable most of the world's population to live and multiply: grains, beans, and vegetables. And because of the remarkable productivity of American agriculture, there usually would be enough grain and beans in storage to supply surviving Americans with sufficient food for at least a year following a heavy nuclear attack.²⁸ The problem would be to get the unprocessed foods, which are stored in food-producing regions, to the majority of survivors who would be outside these regions.

Surprisingly little transportation would be needed to carry adequate quantities of these unprocessed foods to survivors in famine areas. A single large trailer truck can haul 40,000 pounds of wheat—enough to keep 40,000 people from feeling hunger pains for a day. More than enough such trucks and the fuel needed to carry basic foods to food-short areas would survive a massive nuclear attack.²⁸ It is likely that reasonably strong American leadership and morale would prevail so that, after the first few weeks, millions of the survivors in starving areas should receive basic unprocessed foods.

Eating food produced in the years after a large attack would cause an increase in the cancer rate, due primarily to its content of radioactive strontium

and cesium from fallout-contaminated soil. Over the first 30 years following an attack, this increase would be a small fraction of the number of additional cancer deaths that would result from external radiation.²⁹ Cancer deaths would be one of the tragic, delayed costs of a nuclear war, but all together would not be numerous enough to endanger the long-term survival of the population.

LIVE OFF THE LAND?

Very few survivors of a heavy attack would be in areas where they could live off the land like primitive hunters and gatherers. In extensive areas where fallout would not be heavy enough to kill human beings, wild creatures would die from the combined effects of external gamma radiation, swallowed fallout particles, and beta burns on their bodies. Survival plans should not include dependence on hunting, fishing, or gathering wild plants.

FOOD FOR SHELTER OCCUPANTS

Most people would need very little food to live several weeks; however, the time when survivors of blast and fallout would leave their shelters would mark the beginning of a much longer period of privation and hard manual labor. Therefore, to maintain physical strength and morale, persons in shelters ideally should have enough healthful food to provide well-balanced, adequate meals for many weeks.

In most American homes there are only enough ready-to-eat, concentrated foods to last a few days. Obviously, it would be an important survival advantage to keep on hand a two-week supply of easily transportable foods. In any case, occupants of shelters would be uncertain about when they could get more food and would have to make hard decisions about how much to eat each day. (Those persons who have a fallout meter, such as the homemade instrument described in Chapter 10, could estimate when and for how long they could emerge from shelter to find food. As a result, these persons could ration their limited foods more effectively.)

During the first few weeks of a food crisis, lack of vitamins and other essentials of a well-balanced diet would not be of primary importance to previously well-nourished people. Healthful foods with enough calories to provide adequate energy would meet short-term needs. If water is in short supply, high-protein foods such as meat are best eaten only

in moderation, since a person eating high-protein foods requires more water than is needed when consuming an equal number of calories from foods high in carbohydrates.

EXPEDIENT PROCESSING OF GRAINS AND SOYBEANS

Whole-kernel grains or soybeans cannot be eaten in sufficient quantities to maintain vigor and health if merely boiled or parched. A little boiled whole-kernel wheat is a pleasantly chewy breakfast cereal, but experimenters at Oak Ridge got sore tongues and very loose bowels when they tried to eat enough boiled whole-kernel wheat to supply even half of their daily energy needs. Some pioneers, however, ate large quantities of whole-kernel wheat without harmful results after boiling and simmering it for many hours. Even the most primitive peoples who subsist primarily on grains grind or pound them into a meal or paste before cooking. (Rice is the only important exception.) Few Americans know how to process whole-kernel grains and soybeans (our largest food reserves) into meal. This ignorance could be fatal to survivors of a nuclear attack.

Making an expedient metate, the hollowed-out grinding stone of Mexican Indians, proved impractical under simulated post-attack conditions. Pounding grain into meal with a rock or a capped, solid-ended piece of pipe is extremely slow work. The best expedient means developed and field-tested for pounding grain or beans into meal and flour is an improvised 3-pipe grain mill. Instructions for making and using this effective grain-pounding device follow.

Improved Grain Mill

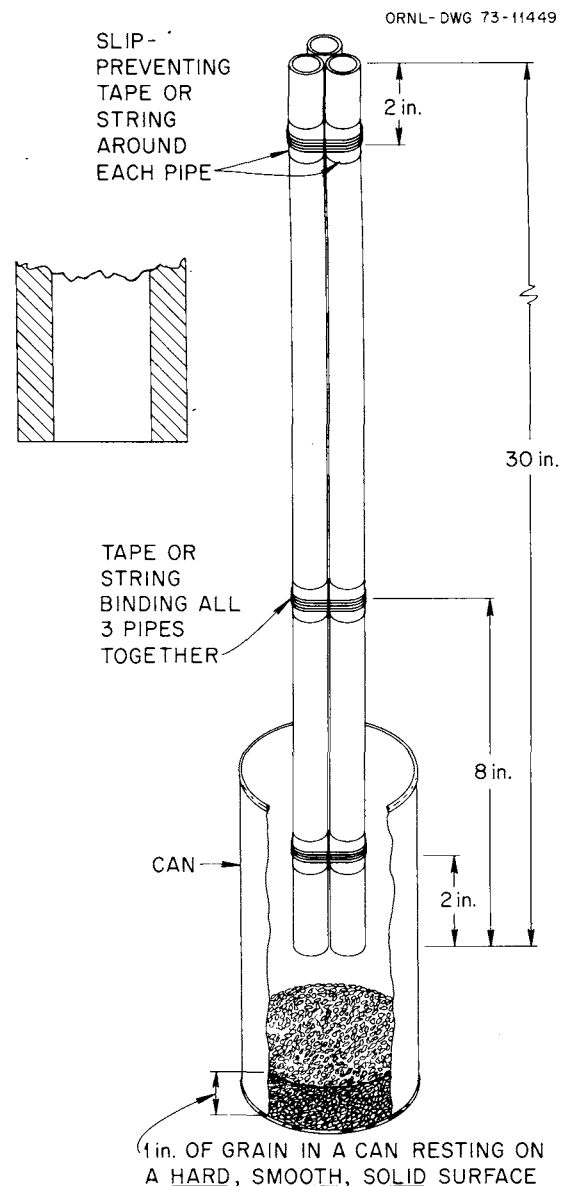
The grain mill described can efficiently pound whole-grain wheat, corn, etc., into meal and flour—thereby greatly improving digestibility and avoiding the diarrhea and sore mouths that would result from eating large quantities of unground grain.

TO BUILD:

- (1) Cut 3 lengths of pipe, each 30 inches long; $\frac{3}{4}$ -inch-diameter steel pipe (such as ordinary water pipe) is best.
- (2) Cut the working ends of the pipe off squarely. Remove all roughness, leaving the full-wall thickness. Each working end should have the full diameter of the pipe.
- (3) In preparation for binding the three pieces of pipe together into a firm bundle, encircle each

piece of pipe with cushioning, slip-preventing tape, string or cloth—in the locations illustrated.

- (4) Tape or otherwise bind the 3 pipes into a secure bundle so that their working ends are as even as possible and are in the same plane—resting evenly on a flat surface.
- (5) Cut the top smoothly out of a large can. A 4-inch-diameter, 7-inch-high fruit-juice can is ideal. If you do not have a can, improvise something to keep grain together while pounding it.



TO MAKE MEAL AND FLOUR:

- (1) Put clean, dry grain ONE INCH DEEP in the can.
- (2) To prevent blistering your hands, wear gloves, or wrap cloth around the upper part of the bundle of pipes.
- (3) Place the can (or open-ended cylinder) on a *hard, smooth, solid* surface, such as concrete.
- (4) To pound the grain, sit with the can held between your feet. Move the bundle of pipes straight up and down about 3 inches, with a rapid stroke.
- (5) If the can is 4 inches in diameter, in 4 minutes you should be able to pound $\frac{1}{2}$ lb (one cup) of whole-kernel wheat into $\frac{1}{5}$ lb of fine meal and flour, and $\frac{3}{10}$ lb of coarse meal and fine-cracked wheat.
- (6) To separate the pounded grain into fine meal, flour, coarse meal, and fine-cracked wheat, use a sieve made of window screen.
- (7) To separate flour for feeding small children, place some pounded grain in an 18 × 18-inch piece of fine nylon net, gather the edges of the net together so as to hold the grain, and shake this bag-like container.
- (8) To make flour fine enough for babies, pound fine meal and coarse flour still finer, and sieve it through a piece of cheesecloth or similar material.

As soon as fallout decay permits travel, the grain-grinding machines on tens of thousands of hog and cattle farms should be used for milling grain for survivors. It is vitally important to national recovery and individual survival to get back as soon as possible to labor-saving, mechanized ways of doing essential work.

In an ORNL experiment, a farmer used a John Deere Grinder-Mixer powered by a 100-hp tractor to grind large samples of wheat and barley. When it is used to grind rather coarse meal for hogs, this machine is rated at 12 tons per hour. Set to grind a finer meal-flour mixture for human consumption, it ground both hard wheat and feed barley at a rate of about 9 tons per hour. This is 2400 times as fast as using muscle power to operate even the best expedient grain mill. With its finest screen installed, this large machine can produce about 3 tons of whole wheat flour per hour.

Unlike wheat and corn, the kernels of barley, grain sorghums, and oats have rough, fibrous hulls

that must be removed from the digestible parts to produce an acceptable food. Moistening the grain will toughen such hulls and make them easier to remove. If the grain is promptly pounded or ground into meal, the toughened hulls will break into larger pieces than will the hulls of undampened grain. A small amount of water, weighing about 2% of the weight of the grain, should be used to dampen the grain. For 3 pounds of grain (about 6 cups), sprinkle with about one ounce (28 grams, or about 2 tablespoons) of water, while stirring constantly to moisten all the kernels. After about 5 minutes of stirring, the grain will appear dry. The small amount of water will have dampened and toughened the hulls, but the edible parts inside will have remained dry. Larger pieces of hull are easier to remove after grinding than smaller pieces.

One way to remove ground-up hulls from meal is by flotation. Put some of the meal-hulls mixture about 1 inch deep in a pan or pot, cover the mixture with water, and stir. Skim off the floating hulls, then pour off the water and more hulls. Sunken pieces of hulls that settle on top of the heavier meal can be removed with one's fingers as the last of the water is poured off. To produce a barley meal good for very small children, the small pieces of hulls must again be separated by flotation.

Figure 9.1 illustrates sieving fine, dry barley meal and the smaller pieces of hulls from the coarser

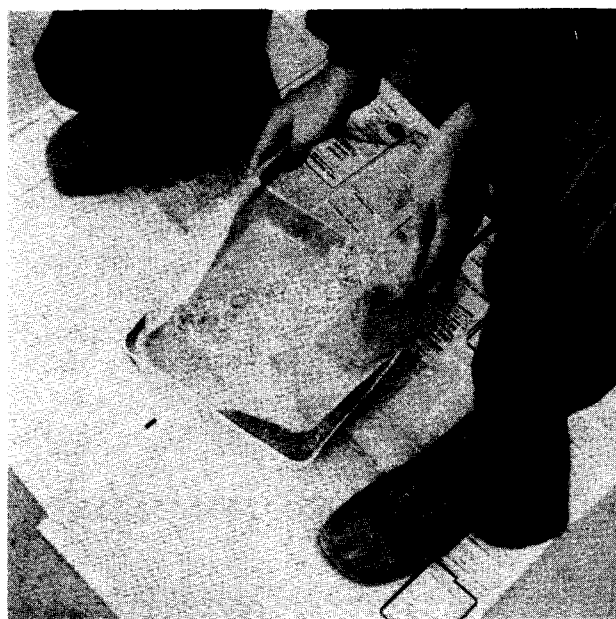


Fig. 9.1. Sieving ground barley through a window-screen sieve.

meal and the larger pieces. The sieve was made of a piece of window screen that measured 20×20 inches before its sides were folded up and wired to form an open-topped box.

To lessen their laxative effects, all grains should be ground as finely as possible, and most of the hulls should be removed. Grains also will be digested more easily if they are finely ground. The occupants of crowded shelters should be especially careful to avoid foods that cause diarrhea.

COOKING WITH MINIMUM FUEL

In areas of heavy fallout, people would have to remain continuously in crowded shelters for many days. Then they would have to stay in the shelters most of each 24 hours for weeks. Most shelter occupants soon would consume all of their ready-to-eat foods; therefore, they should have portable, efficient cook stoves. A cook stove is important for another reason: to help maintain morale. Even in warm weather, people need some hot food and drink for the comforting effect and to promote a sense of well-being. This is particularly true when people are under stress. The Bucket Stove pictured on the following pages (Figs. 9.2 and 9.3) was the most satisfactory of several models of expedient stoves developed at Oak Ridge and later field-tested.

● Bucket Stove

If operated properly, this stove burns only about $\frac{1}{2}$ pound of dry wood or newspaper to heat 3 quarts of water from 60°F to boiling.

Materials required for the stove:

* A metal bucket or can, 12- to 16-quart sizes preferred. The illustrations show a 14-quart bucket and a 6-quart pot.

* Nine all-metal coat hangers for the parts made of wire. (To secure the separate parts of the movable coat-hanger wire grate, 2 feet of finer wire is helpful.)

* A 6×10 -inch piece of a large fruit-juice can, for a damper.

Construction:

With a chisel (or a sharpened screw driver) and a hammer, cut a $4\frac{1}{2} \times 4\frac{1}{2}$ -inch hole in the side of the bucket about $1\frac{1}{2}$ inches above its bottom. To avoid denting the side of the bucket when chiseling out the hole, place the bucket over the end of a log or similar solid object.

To make the damper, cut a 6-inch-wide by 10-inch-high piece out of a large fruit-juice can or from similar light metal. Then make the two coat-hanger-wire springs illustrated, and attach them to the piece of metal by bending and hammering the outer 1 inch of the two 6-inch-long sides over and around the two spring wires. This damper can be slid up and down, to open and close the hole in the bucket. The springs hold it in any desired position. (If materials for making this damper are not available, the air supply can be regulated fairly well by placing a brick, rock, or piece of metal so that it will block off part of the hole in the side of the bucket.)

To make a support for the pot, punch 4 holes in the sides of the bucket, equally spaced around it and about $3\frac{1}{2}$ inches below the bucket's top. Then run a coat-hanger wire through each of the two pairs of holes on opposite sides of the bucket. Bend these two wires over the top of the bucket, as illustrated, so that their four ends form free-ended springs to hold the cooking pot centered in the bucket. Pressure on the pot from these four free-ended, sliding springs does not hinder putting it into the stove or taking it out.

Bend and twist 4 or 5 coat hangers to make the movable grate, best made with the approximate dimensions given in Fig. 9.2.

For adjusting the burning pieces of fuel on the grate, make a pair of 12-inch-long tongs of coat-hanger wire, as illustrated by Fig. 9.3.

To lessen heat losses through the sides and bottom of the bucket, cover the bottom with about 1 inch of dry sand or earth. Then line part of the inside and bottom with two thicknesses of heavy-duty aluminum foil, if available.

To make it easier to place the pot in the stove or take it out without spilling its contents, replace the original bucket handle with a longer piece of strong wire.

Operation:

The Bucket Stove owes its efficiency to: (1) the adjustable air supply that flows up through the burning fuel, (2) the movable grate that lets the operator keep the maximum amount of flame in contact with the bottom of the cooking pot, and (3) the space between the sides of the pot and the inside of the bucket that keeps the rising hot gases in close contact with the sides of the pot.

In a shelter, a Bucket Stove should be placed as near as practical to an air exhaust opening before a fire is started in it.

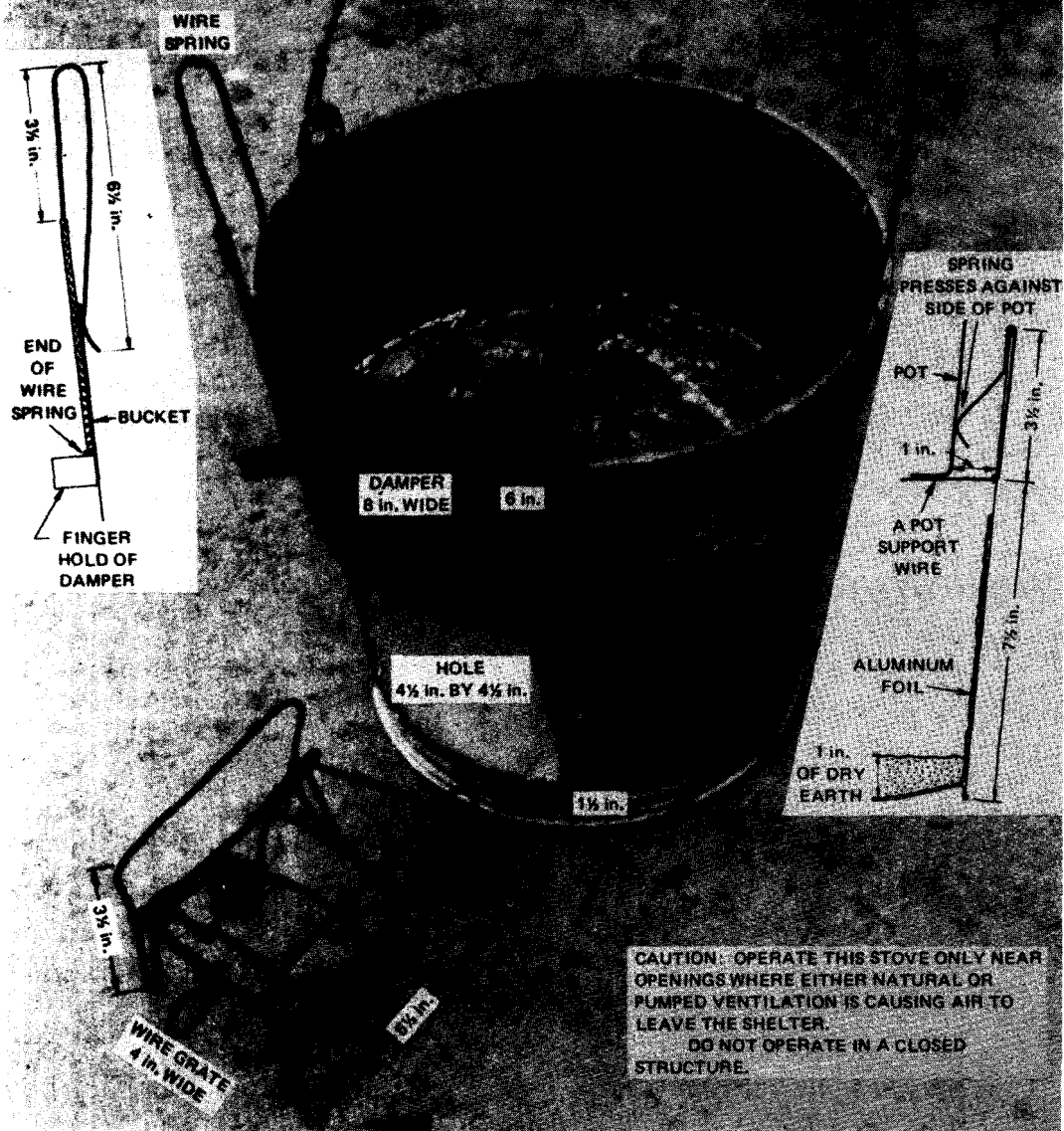


Fig. 9.2. Bucket-stove with adjustable damper and movable wire grate.

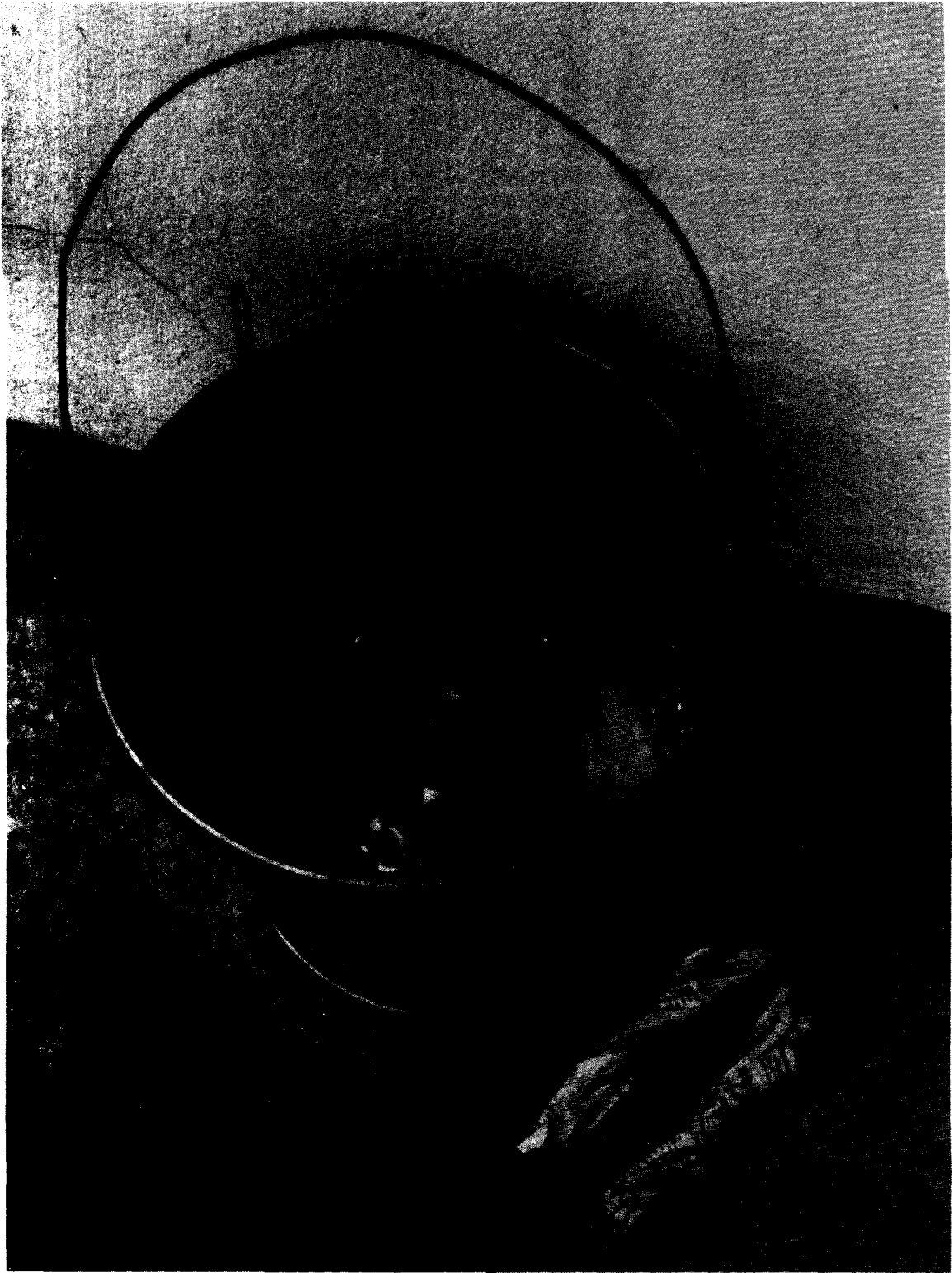


Fig. 9.3. Bucket-stove with its sliding damper partly closed. Foot-long tongs of coat hanger wire are especially useful when burning twisted half-pages of newspaper.

If wood is to be burned, cut and split dry wood into small pieces approximately $\frac{1}{2}$ inch square and 6 inches long. Start the fire with paper and small slivers of wood, placing some under the wire grate. To keep fuel from getting damp in a humid shelter, keep it in a large plastic bag.

If newspaper is to be burned, use half-pages folded and twisted into 5-inch-long "sticks," as illustrated. Using the wire tongs, feed a paper "stick" into the fire about every half-minute.

Add fuel and adjust the damper to keep the flame high enough to reach the bottom of the pot, but not so high as to go up the sides of the pot.

To use the Bucket Stove for heating in very cold weather, remove the pot and any insulation around the sides of the bucket; burn somewhat more fuel per minute.

If used with the Fireless Cooker described on the following pages, a Bucket Stove can be used to thoroughly cook beans, grain, or tough meat in water. Three quarts of such food can be cooked with less fuel than is required to soft-boil an egg over a small campfire.

● Fireless Cooker

A Fireless Cooker cooks by keeping a lidded pot of boiling-hot food so well insulated all around that it loses heat very slowly. Figure 9.4 shows one of these simple fuel-saving devices made from a bushel basket filled with insulating newspapers, with a towel-lined cavity in the center. The cavity is the size of the 6-quart pot. A towel in this cavity goes all around the pot and will be placed over it to restrict air circulation. If the boiling-hot pot of food is then covered with newspapers about 4 inches thick, the temperature will remain for hours so near boiling that in 4 or 5 hours even slow-cooking food will be ready to eat.

The essential materials for making an effective Fireless Cooker are enough of any good insulating materials (blankets, coats, paper, hay that is dry and pliable) to cover the boiling-hot pot all over with at least 3 or 4 inches of insulation. A container to keep the insulating materials in place around the pot is useful.

Wheat, other grains, and small pieces of tough meat can be thoroughly cooked by boiling them briskly for only about 5 minutes, then insulating the pot in a Fireless Cooker for 4 or 5 hours, or



Fig. 9.4. Boiling-hot pot of food being placed in an expedient Fireless Cooker.

overnight. Whole beans should be boiled for 10 to 15 minutes before they are placed in a Fireless Cooker.

COOKING GRAIN AND BEANS WHEN SHORT OF FUEL OR POTS

● Cooking Grain Alone

When whole grains are pounded or ground by expedient means, the result usually is a mixture of coarse meal, fine meal, and a little flour. Under shelter conditions, the best way to cook such meal is first to bring the water to a boil (3 parts of water for 1 part of meal). Add 1 teaspoon (5 grams) of salt per pound of dry meal. Remove the pot from the fire (or stop adding fuel to a Bucket Stove) and quickly stir the meal into the hot water. (If the meal is stirred into briskly boiling water, lumping becomes a worse problem.) Then, while stirring constantly, again bring the pot to a rolling boil. Since the meal is just beginning to swell, more unabsorbed water remains, so there is less sticking and scorching than if the meal were added to cold water and then brought to a boil.

If any type of Fireless Cooker is available, the hot cereal only has to be boiled and stirred long enough so that no thin, watery part remains. This usually takes about 5 minutes. Continue to cook, either in the Fireless Cooker for at least 4 or 5 hours, or by boiling for an additional 15 or 20 minutes.

When it is necessary to boil grain meal for many minutes, minimize sticking and scorching by cooking 1 part of dry meal with at least 4 parts of water. However, cooking a thinner hot cereal has a disadvantage during a food crisis: an increased volume of food must be eaten to satisfy one's energy needs.

If grain were the only food available, few Americans doing physical work could eat enough of it to maintain their weight at first, until their digestive tracts enlarged from eating the very bulky foods. This adaptation could take a few months. Small children could not adjust adequately to an all-grain diet; for them, concentrated foods such as fats also are needed to provide enough calories to maintain growth and health.

● Cooking Grain and Beans Together

When soybeans are being used to supplement the lower quality proteins of grain and when fuel or pots are in short supply, first grind or pound the beans into a fine meal. To further reduce cooking time, soak the bean meal for a couple of hours, keeping it covered with water as it swells. Next put the soaked bean meal into a pot containing about 3 times as much water as the combined volume of a mixture of 1 part of dry bean meal and 3 or 4 parts of dry grain meal. Gently boil the bean meal for about 15 minutes, stirring frequently, before adding the grain meal and completing the cooking.

Stop boiling and add the grain meal while stirring constantly. Again bring the pot to a boil, stirring to prevent sticking and scorching, and boil until the meal has swelled enough to have absorbed all the water. After salting, boil the grain-bean mush for another 15 minutes or more before eating, or put it in a fireless cooker for at least 4 or 5 hours.

Soybeans boiled alone have a taste that most people find objectionable. Also, whole soybeans must be boiled for a couple of hours to soften them sufficiently. But if soybeans are pounded or ground into a fine meal, and then 1 part of the soybean meal is boiled with 4 parts of meal made from corn or another grain, the soybeans give a pleasant sweetish taste to the resulting mush. The unpleasant soybean taste is eliminated. If cooked as described above, soybeans and other beans or dried peas can be made digestible and palatable with minimum cooking.

100% GRAIN AND 100% BEAN DIETS

A diet consisting solely of wheat, corn, or rice, and salt has most of the essential nutrients. The critical deficiencies would be vitamins A, C, and D. Such a grain-based diet can serve adults and older children as their "staff of life" for months. Table 9.1 shows how less than 1³/₄ pounds of whole wheat or dry yellow corn satisfies most of the essential nutritional requirements of a long-term emergency ration. [The nutritional values that are deficient are printed in bold type, to make an easier comparison with the Emergency Recommendations, also printed in bold type. Food energy is given in kilocalories (kcal), commonly called calories (Cal).] Expedient ways of supplying the nutrients missing from these rations are described in a following section of this chapter.

Other common whole grains would serve about as well as wheat and yellow corn. At least ¹/₆ oz of salt per day (about 5 grams) is essential for any ration that is to be eaten for more than a few days, but ¹/₃ oz (about 10 g or ³/₄ tablespoon) should be available to allow for increased salt needs and to make grain and beans more palatable. This additional salt would be consumed as needed.

To repeat: few Americans at first would be able to eat the 3 or 4 quarts of thick mush that would be necessary with a ration consisting solely of whole-kernel wheat or corn. Only healthy Americans determined to survive would be likely to fare well for months on such unaccustomed and monotonous food as an all-grain diet. Eating two or more different kinds of grain and cooking in different ways would make an all-grain diet both more acceptable and more nourishing.

Not many people would be able to eat 27 oz (dry weight before cooking) of beans in a day, and fewer yet could eat a daily ration of almost 23 oz of soybeans. Beans as single-food diets are not recommended because their large protein content requires the drinking of more fluids. Roasted peanuts would provide a better single-food ration.

GRAIN SUPPLEMENTED WITH BEANS

People who live on essentially vegetarian diets eat a little of their higher-quality protein food *at every meal*, along with the grain that is their main source of nutrition. Thus Mexicans eat some beans along with their corn tortillas, and Chinese eat a little fermented soybean food or a bit of meat or fish with a bowl of rice. Nutritionists have found that grains

Table 9.1. Daily rations of 100% grain, beans, or peanuts^a

	Wheat (dry)	Yellow Field Corn ^b (dry)	Emergency Recommendations	Soybeans (dry)	Red Beans (dry)	Peanuts (roasted)
Weight	790g (27.8 oz)	750g (26.4 oz)		645g (22.7 oz)	760g (26.8 oz)	447g (15.8 oz)
Energy, kcal	2600	2600	2600	2600	2600	2600
Protein, g	103	67	55 ^c	220	171	117
Fat, g	15	29	30	114	11	218
Calcium, mg	324	165	400	1458	836	322
Magnesium, mg	1260	1100	200-300	1710	1240	782
Iron, mg	26	15.7	10	54.2	52.4	9.8
Potassium, mg	2920	2130	1500-2000	10800	7420	3132
Vitamin A, RE	0	368	555	52	15	0
Thiamin, mg	4.3	2.8	1.0	7.1	3.9	1.3
Riboflavin, mg	1.0	0.9	1.4	2.0	1.5	0.6
Niacin, mg	34.0	16.5 ^d	17.0	14.2	17.5	76.4
Vitamin C, mg	0	0	15-30	0	0	0
Vitamin D, μ g	0	0	0 ^e	0	0	0

^aSalt (1/2 oz, or 10 g, or 1/2 tablespoon) should be available. This would be consumed as needed.

^bWhite corn supplies no Vitamin A, whereas yellow corn supplies 49 RE (retinol equivalent, a measure of Vitamin A value) per 100 g dry weight. Most corn in the United States is yellow corn.

^cIf a diet contains some animal protein such as meat, eggs, or milk, the recommended protein would be less than 55 g per day. If most of the protein is from milk or eggs, only 41 g per day is recommended.

^dThe niacin in corn is not fully available unless the corn is treated with an alkali, such as the lime or ashes Mexicans (and many Americans) add to the water in which corn kernels are soaked or boiled.

^eInfants, children, and pregnant and lactating women should receive 10 μ g (10 micrograms, or 400 IU) of vitamin D. For others, the current recommended daily allowance (RDA) for vitamin D is 200 IU (5 μ g).

are low in some of the essential amino acids that the human body needs to build its proteins. For long-term good health, the essential amino acids must be supplied in the right proportions *with each meal* by eating some foods with more complete proteins than grains have. Therefore, in a prolonged food crisis one should strive to eat *at every meal* at least a little of any higher-quality protein foods that are available. These include ordinary beans, soybeans, milk powder, meat, and eggs.

Table 9.2 shows that by adding 7.0 oz (200 g) of red beans (or other common dried beans) to 21.1 oz (600 g) of either whole wheat or yellow corn, with salt added, you can produce rations that contain adequate amounts of all the important nutrients except vitamin C, vitamin A, vitamin D, and fat. If 5.3 oz (150 g) of soybeans are substituted for the red beans, the fat requirement is satisfied. The 600 g of yellow corn contains enough carotene to enable the body to produce more than half the emergency recommendation of vitamin A. The small deficiencies in riboflavin would not cause sickness.

Other abundant grains, such as grain sorghums or barley, may be used instead of the wheat or corn shown in Table 9.2 to produce fairly well-balanced rations. Other legumes would serve to supplement grain about as well as red beans. (Peanuts are the exception: although higher in energy (fat) than any other unprocessed

food, the quality of their protein is not as high as that of other legumes.)

EXPEDIENT WAYS TO SUPPLY DEFICIENT ESSENTIAL NUTRIENTS

● Vitamin C

A deficiency of vitamin C (ascorbic acid) causes scurvy. This deadly scourge would be the first nutritional disease to afflict people having only grain and/or beans and lacking the know-how needed to sprout them and produce enough vitamin C. Within only 4 to 6 weeks of eating a ration containing no vitamin C, the first symptom of scurvy would appear: swollen and bleeding gums. This would be followed by weakness, then large bruises, hemorrhages, and wounds that would not heal. Finally, death from hemorrhages and heart failure would result.

The simplest and least expensive way to make sure that you, your family and neighbors do not suffer or die post-attack from scurvy is to buy one kilogram (1,000,000 milligrams) of pure vitamin C, which is the crystalline "ascorbic acid" form. Unlike vitamin C tablets, pure vitamin C crystals do not deteriorate. An inexpensive mailorder source is Bronson Pharmaceutical, 4526 Rinetti Lane, La Canada, California 91011;

Table 9.2. Daily rations of whole wheat or yellow corn supplemented with soybeans or red beans.
Recommended daily salt ration, including salt in food: $\frac{3}{4}$ tablespoon ($\frac{1}{3}$ oz, or 10 g).

	600g (21.1 oz) Whole wheat plus 200g (7.0 oz) Red beans (dry wt)	600g (21.1 oz) Whole wheat plus 150g (5.3 oz) Soybeans (dry wt)	Emergency Recommendations	600g (21.1 oz) Yellow corn ^a plus 150g (5.3 oz) Soybeans (dry wt)	600g (21.1 oz) Yellow corn plus 200g (7.0 oz) Red beans (dry wt)
Energy, kcal	2,666	2,585	2,600	2,693	2,774
Protein, g	123	129	55 ^b	105	98
Fat, g	15	39	30	50	26
Calcium, mg	466	585	400	471	352
Magnesium, mg	1,286	1,358	200 300	1,280	1,208
Iron, mg	33.6	32.4	10	25.2	26.4
Potassium, mg	4,188	4,736	1,500 2,000	4,220	3,672
Vitamin A, RE	4	12	555	306	298
Thiamin, mg	4.3	5.0	1.0	3.9	3.2
Riboflavin, mg	1.1	1.2	1.4	1.2	1.1
Niacin, mg	30.4	29.1	17.0	16.5 ^c	17.8
Vitamin C, mg	0	0	15 30	0	0
Vitamin D, μ g	0	0	0 ^d	0	0

^aWhite corn supplies no vitamin A, whereas yellow corn supplies 49RE (retinol equivalent, a measure of vitamin A value) per 100g dry weight. Most corn in the United States is yellow corn.

^bIf a diet contains animal protein such as meat, eggs or milk, the recommended protein would be less than 55g per day. If all the protein is from milk or eggs, only 41g per day is required.

^cThe niacin in corn is not fully available unless corn is treated with an alkali, such as the lime or ashes added by Mexicans and Americans in the South and Southwest to the water in which they soak or boil corn kernels.

^dInfants, children, and pregnant and lactating women should receive 10 μ g (10 micrograms, or 400 IU) of vitamin D. For others, the current recommended daily allowance (RDA) for vitamin D is 200 IU (5 μ g).

in 1988 I bought one kilogram for \$18.75, postage paid. An ample daily dose is 25 milligrams, about 0.0009 ounce. Ten grams (about one third ounce) is enough for a whole year for one person who is eating only unsprouted grain and/or other foods providing **no** vitamin C. One gram (1,000 mg) of crystalline ascorbic acid is $\frac{1}{4}$ teaspoonful. If you do not have a $\frac{1}{4}$ teaspoon, put one **level** teaspoonful of the crystals on a piece of paper, and divide the little pile into 4 equal parts; each will be approximately 1,000 mg. One of these 1,000 mg piles can easily be divided into 4 tiny piles, each 250 mg. A 250 mg pile provides 10 ample daily doses of 25 mg each. If your family has a 1,000,000 mg supply, taking a 50 mg daily dose of pure crystalline ascorbic acid may be preferred, either sprinkled on food or dissolved in water.

One good expedient way to prevent or cure scurvy is to eat sprouted seeds — not just the sprouts. Sprouted beans prevented scurvy during a famine in India. Captain James Cook was able to keep his sailors from developing scurvy during a three-year voyage by having them drink an unfermented beer made from dried, sprouted barley. For centuries the Chinese have prevented scurvy during the long winters of northern China by consuming sprouted beans.

Only 10 mg of vitamin C taken each day (1/5 of the smallest vitamin C tablet) is enough to prevent scurvy. If a little over an ounce (about 30 grams) of dry

beans or dry wheat is sprouted until the sprouts are a little longer than the seeds, the sprouted seeds will supply 10 to 15 mg of vitamin C. Such sprouting, if done at normal room temperature, requires about 48 hours. To prevent sickness and to make sprouted beans more digestible, the sprouted seeds should be boiled in water for not longer than 2 minutes. Longer cooking will destroy too much vitamin C.

Usual sprouting methods produce longer sprouts than are necessary when production of enough vitamin C is the objective. These methods involve rinsing the sprouting seeds several times a day in safe water. Since even survivors not confined to shelters are likely to be short of water, the method illustrated in Fig. 9.5 should be used. First the seeds to be sprouted are picked clean of trash and broken seeds. Then the seeds are covered with water and soaked for about 12 hours. Next, the water is drained off and the soaked, swollen seeds are placed on the inside of a plastic bag or a jar, in a layer no more than an inch deep. If a plastic bag is used, you should make two loose rolls of paper, crumple them a little, dampen them, and place them inside the bag, along its sides. As shown in Fig. 9.5, these two dampened paper rolls keep the plastic from resting on the seeds and form an air passage down the center of the bag. Wet paper should be placed in the mouth of the bag or jar so as to leave an air opening of only about 1 square inch. If this paper is kept moist, the seeds will remain sufficiently damp while receiving enough circulating air to prevent molding. They will sprout sufficiently after about 48 hours at normal room temperature.



Fig. 9.5. Sprouting with minimum water.

Sprouting seeds also increases their content of riboflavin, niacin, and folic acid. Sprouted beans are more digestible than raw, unsprouted beans, but not as easily digested or nourishing as are sprouted beans that have been boiled or sauteed for a couple of minutes. Sprouting is not a substitute for cooking. Contrary to the claims of some health food publications, sprouting does not increase the protein content of seeds, nor does it improve protein quality. Furthermore, sprouting reduces the caloric value of seeds. The warmth generated by germinating seeds reduces their energy value somewhat, as compared to unsprouted seeds.

● Vitamin A

Well-nourished adults have enough vitamin A stored in their livers to prevent vitamin A deficiency problems for several months, even if their diet during that time contains none of this essential vitamin. Children would be affected by deficiencies sooner than adults. The first symptom is an inability to see well in dim light. Continuing deficiency causes changes in body tissues. In infants and children, lack of vitamin A can result in stunted growth and serious eye problems—even blindness. Therefore, a survival diet should be balanced with respect to vitamin A as soon as possible, with children having priority.

Milk, butter, and margarine are common vitamin A sources that would not be available to most survivors. If these were no longer available,

yellow corn, carrots, and green, leafy vegetables (including dandelion greens) would be the best sources. If these foods were not obtainable, the next best source would be sprouted whole-kernel wheat or other grains—if seeds could be sprouted for three days *in the light*, so that the sprouts are green. Although better than no source, sprouting is not a very satisfactory way to meet vitamin A requirements. The development of fibrous roots makes 3-day sprouted wheat kernels difficult to eat. And one must eat a large amount of seeds with green sprouts and roots to satisfy the recommended daily emergency requirements—up to 5½ cups of 5-day sprouted alfalfa seeds. Survivors of a nuclear attack would wish they had kept an emergency store of multivitamin pills.

● Vitamin D

Without vitamin D, calcium is not adequately absorbed. As a result, infants and children would develop rickets (a disease of defective bone mineralization). A massive nuclear attack would cut off the vast majority of Americans from their main source of vitamin D, fortified milk.

Vitamin D can be formed in the body if the skin is exposed to the ultraviolet rays of the sun. Infants should be exposed to sunlight very cautiously, initially for only a few minutes—especially after a massive nuclear attack. Such an attack possibly could cause atmospheric changes that would permit more ultraviolet light to reach the earth's surface, causing sunburn in the U.S. as severe as on the equator today. In cold weather, maximum exposure of skin to sunlight is best done in a shallow pit shielded from the wind. Exposure in a shallow pit would give about 90 percent protection from gamma radiation from fallout particles on the surrounding ground.

● Niacin and Calcium

Niacin deficiency causes pellagra, a disease that results in weakness, a rash on skin exposed to the sun, severe diarrhea, and mental deterioration. If a typical modern American had a diet primarily of corn and lacked the foods that normally supply niacin, symptoms of pellagra would first appear in about 6 months. Since corn is by far our largest crop—the U.S. production in 1985 was about 425 billion pounds—the skillful treatment of corn would be important to post-attack survival and recovery.

During the first part of this century, pellagra killed thousands of Americans in the South each year. These people had corn for their principal staple and ate few animal protein foods or beans. Yet

Mexicans, who eat even more corn than did those Southerners—and have even fewer foods of animal origin—do not suffer from pellagra.

The Mexicans' freedom from pellagra is mainly due to their traditional method of soaking and boiling their dried corn in a lime-water solution. They use either dry, unslaked lime (calcium oxide, a dangerously corrosive substance made by roasting limestone) or dry, slaked lime (calcium hydroxide, made by adding water to unslaked lime). Dry lime weighing about 1% as much as the dry corn is added to the soak water, producing an alkaline solution. Wood ashes also can be used instead of lime to make an alkali solution. The alkali treatment of corn makes the niacin available to the human body. Tables 9.1 and 9.2 show corn as having adequate niacin. However, the niacin in dried corn is not readily available to the body unless the corn has received an alkali treatment.

Treating corn with lime has another nutritional advantage: the low calcium content of corn is significantly increased.

● Fat

The emergency recommendation for fat is slightly over 1 ounce per day (30 g) of fat or cooking oil. This amount of fat provides only 10% of the calories in the emergency diet, which does not specify a greater amount because fats would be in very short supply after a nuclear attack. This amount is very low when compared to the average diet eaten in this country, in which fat provides about 40% of the calories. It would be difficult for many Americans to consume sufficient calories to maintain normal weight and morale without a higher fat intake; more fat should be made available as soon as possible. Increased fat intake is especially important for young children, to provide calories needed for normal growth and development. Oak Ridge National Laboratory field tests have shown that toddlers and old people, especially, prefer considerably more oil added to grain mush than the emergency recommendation of 10%.

● Vitamin B-12 and Animal Protein

Vitamin B-12 is the only essential nutrient that is available in nature solely from animal sources. Since a normal person has a 2 to 4-year supply of vitamin B-12 stored in his liver, a deficiency should not

develop before enough food of animal origin would again be available.

Many adults who are strict vegetarians keep in good health for years without any animal sources of food by using grains and beans together. It is more difficult to maintain normal growth and development in young children on vegetarian diets. When sufficient animal sources of food are available, enough should be provided to supply 7 grams of animal protein daily. This could be provided by about 1.4 ounces (38 g) of lean meat, 0.7 ounce (20 g) of nonfat dry milk, or one medium-sized egg. When supplies are limited, young children should be given priority. Again: a little of these high-grade supplementary protein foods should be eaten with every meal.

● Iron

Most people live out their lives without benefit of an iron supplement. However, many pregnant and nursing women and some children need supplemental iron to prevent anemia. One tested expedient way to make more iron available is to use iron pots and pans, especially for cooking acid foods such as tomatoes. Another is to place plain iron nails (not galvanized nails) in vinegar until small amounts of iron begin to float to the surface. This usually takes 2 to 4 weeks. Then a teaspoon of iron-vinegar solution will contain about 30 to 60 mg of iron, enough for a daily supplement. The emergency recommendation is 10 mg per day. A teaspoon of the iron-vinegar solution is best taken in a glass of water. The iron content of fruit, such as an apple, can be increased by placing iron nails in it for a few days.

FOOD RESERVES

Russia, China, and other countries that make serious preparations to survive disasters store large quantities of food—primarily grain—both in farming areas and near population centers. In contrast, the usually large U.S. stocks of grain and soybeans are an unplanned survival resource resulting from the production of more food than Americans can eat or sell abroad. The high productivity of U.S. agriculture is another unplanned survival asset. Providing enough calories and other essential nutrients for 100 million surviving Americans would necessitate the annual raising of only about 12% of our 1985 crop of corn, wheat, grain sorghum, and soybeans — if nothing else were produced. In 1985, the U.S.

production of corn, wheat, soybeans, and grain sorghum totalled about 625 billion pounds — about 7 pounds per day for one year for every American. A total of 2 pounds per person per day of these basic staples, in the proportions shown in Table 9.2, would be sufficient to provide the essentials of an adequate vegetarian diet weighing about 27 ounces. (Grain sorghum is not listed in Table 9.2; it has approximately the same food value as corn.) The remaining 5 ounces of the 2 pounds would feed enough chickens to meet a survivor's minimum long-term requirement for animal protein.

If corn, wheat, grain sorghum, and soybeans were the only crops raised, the annual production would need to be only 730 pounds per person. Our 1985 annual production would have supplied every adult, child, and infant in a population of 100 million with 6250 pounds of these four staples. This is more than 8 times enough to maintain good nutrition by Chinese standards.

Recovery from a massive nuclear attack would depend largely on sufficient food reserves being available to enable survivors to concentrate on restoring the essentials of mechanized farming. Enough housing would remain intact or could be built to provide adequate shelter for the first few crucial years; enough clothing and fabrics would be available. But if survivors were forced by hunger to expend their energies attempting primitive subsistence farming, many deaths from starvation would occur and the prospects for national recovery would be greatly reduced.

Americans' greatest survival asset at the end of 1985 was about 17 billion bushels (about 850 billion pounds) of wheat, corn, grain sorghums, and soybeans **in storage**, mostly on farms. If 200 million Americans were to survive a limited nuclear attack and if only half of this stored food reserve could be delivered to the needy, each

survivor would have adequate food for over 3 years, by Chinese nutritional standards.

In view of the crucial importance of large food reserves to the prospects for individual and national survival, it is to be hoped that U.S. food surpluses and large annual carry-overs will continue.

A BASIC SURVIVAL RATION TO STORE

A ration composed of the basic foods listed below in Table 9.3 provides about 2600 calories per day and is nutritionally balanced. It keeps better than a ration of typical American foods, requires much less space to store or transport, and is much less expensive. The author and some friends have stored enough of these basic foods to last their families several months during a crisis, and have eaten large quantities of these foods with satisfaction over the past 20 years. (A different emergency ration should be stored for infants and very small children, as will be explained in the following section.) Field tests have indicated that the majority of Americans would find these basic foods acceptable under crisis conditions. In normal times, however, no one should store this or any other emergency food supply until after he has prepared, eaten, and found its components satisfactory.

Unprocessed grains and beans provide adequate nourishment for many millions of the world's people who have little else to eat. Dry grains and beans are very compact: a 5-gallon can holds about 38 pounds of hard wheat. Yet when cooked, dry whole grains become bulky and give a well-fed feeling — a distinct advantage if it is necessary to go on short rations during a prolonged crisis.

This basic ration has two disadvantages: (1) it requires cooking, and (2) Americans are unaccustomed to such a diet. Cooking difficulties can be minimized by having a grain-grinding device, a

Table 9.3. A basic survival ration for multi-year storage

	Ounces per day	Grams per day	Pounds for 30 days full ration	Kilograms for 30 days full ration
Whole-kernel hard wheat	16	454	30.0	13.6
Beans	5	142	9.4	4.3
Non-fat milk powder	2	57	3.8	1.7
Vegetable oil	1	28	1.9	0.9
Sugar	2	57	3.8	1.7
Salt (iodized)	$\frac{1}{3}$	10	0.63	0.3
Total Weights	26 $\frac{1}{3}$	748	49.5	22.5
Multi-vitamin pills:		I pill each day		

bucket stove with a few pounds of dry wood or newspapers for fuel, and the know-how to make a "fireless cooker" by using available insulating materials such as extra clothing. The disadvantage of starting to eat unaccustomed foods at a stressful time can be lessened by eating more whole grains and beans in normal times—thereby, incidentally, saving money and improving a typical American diet by reducing fat and increasing bulk and fiber.

When storing enough of this ration to last for several months or a year, it is best to select several kinds of beans for variety and improved nutrition. If soybeans are included, take into account the differences between soybeans and common beans, as noted earlier in this chapter.

In many areas it is difficult to buy wheat and beans at prices nearly as low as the farmer receives for these commodities. However, in an increasing number of communities, at least one store sells whole-grain wheat and beans in large sacks at reasonable prices. Mormons, who store food for a range of possible personal and national disasters, are often the best sources of information about where to get basic foods in quantity, at reasonable cost. Soon after purchase, bulk foods should be removed from sacks (but not necessarily from sealed-plastic liner-bags) and sealed in metal containers or in thick-walled plastic containers for storage. Especially in the more humid parts of the United States, grain and beans should be frequently checked for moisture. If necessary, these foods should be dried out and rid of insects as described later in this chapter.

Vegetable oil stores as well in plastic bottles as in glass ones. The toughness and lightness of plastic bottles make them better than glass for carrying when evacuating or for using in a shelter. Since a pound of oil provides about $2\frac{1}{4}$ times as much energy as does a pound of sugar, dry grain, or milk powder, storing additional vegetable oil is an efficient way to improve a grain diet and make it more like the 40%-fat diet of typical Americans.

All multivitamin pills providing 5000 International Units (1500 mg retinol equivalent) vitamin A, 400 IU (10 mg) of vitamin D, and 50 to 100 mg of vitamin C, must meet U.S. Government standards, so the least expensive usually are quite adequate. Storage in a refrigerator greatly lengthens the time before vitamin pills must be replaced with fresh ones. Because vitamin C is so essential, yet very

inexpensive and long-lasting, it is prudent to store a large bottle.

It would be wise to have on hand ready-to-eat, compact foods for use during a week or two in a shelter, in addition to those normally kept in the kitchen. It is not necessary to buy expensive "survival foods" or the special dehydrated foods carried by many backpackers. All large food stores sell the following concentrated foods: non-fat milk powder, canned peanuts, compact ready-to-eat dry cereals such as Grape Nuts, canned meat and fish, white sugar, vegetable oil in plastic bottles, iodized salt, and daily multivitamin pills. If shelter occupants have a way to boil water (see Figs. 9.2 and 9.3, Bucket Stove), it is advisable to include rice, noodles, and an "instant" cooked cereal such as oatmeal or wheat—along with coffee and tea for those who habitually drink these beverages.

Parched grain is a ready-to-eat food that has been used for thousands of years. Whole-kernel wheat, corn, and rice can be parched by the following method: Place the kernels about $\frac{1}{4}$ -inch deep in a pan, a skillet, or a tin can while shaking it over a flame, hot coals, or a red hot electric burner. The kernels will puff and brown slightly when parched. These parched grains are not difficult to chew and can be pounded to a meal more easily than can the raw kernels. Parched grain stores well if kept dry and free of insects.

EMERGENCY FOOD FOR BABIES

Infants and very small children would be the first victims of starvation after a heavy nuclear attack, unless special preparations are made on their behalf. Our huge stocks of unprocessed foods, which could prevent the majority of unprepared survivors from dying of hunger, would not be suitable for the very young. They need foods that are more concentrated and less rough. Most American mothers do not nurse their infants, and if a family's supply of baby foods were exhausted the parents might experience the agony of seeing their baby slowly starve.

Few Americans have watched babies starving. In China, I saw anguish on starving mothers' faces as they patted and squeezed their flat breasts, trying to get a little more milk into their weak babies' mouths. I saw this unforgettable tragedy in the midst of tens of thousands of Chinese evacuating on foot before a ruthless Japanese army during World War II. Years later, my wife and I stored several

hundred pounds of milk powder while our five children were small. I believe that parents who fear the use of nuclear weapons will be glad to bear the small expense of keeping on hand the emergency baby foods listed in Table 9.4, below. (More detailed descriptions of these and many other foods, with instructions for their use, are given in an Oak Ridge National Laboratory report, *Maintaining Nutritional Adequacy During A Prolonged Food Crisis*, ORNL-5352, 1979. This report may be purchased for \$6.50 from National Technical Information Service, U.S. Department of Commerce, 5385 Port Royal Road, Springfield, Virginia 22161.)

To make a formula adequate for a 24-hour period, the quantities of instant non-fat dry milk, vegetable cooking oil, and sugar listed in the "Per Day" column of Table 9.4 should be added to 4 cups of safe water. This formula can be prepared daily in cool weather or when a refrigerator is available. In warm or hot weather, or under unsanitary conditions, it is safer to make a formula 3 times a day. To do so, add $\frac{1}{3}$ cup plus 2 teaspoons (a little less than one ounce) of instant non-fat milk powder to $1\frac{1}{3}$ cups ($\frac{2}{3}$ pint) of boiled water, and stir thoroughly. Then add 1 tablespoon (about $\frac{1}{3}$ ounce, or 9 grams) of vegetable oil and 2 teaspoons of sugar, and stir. (If regular bakers' milk powder is used, $\frac{1}{4}$ cup is enough when making one-third of the daily formula, 3 times a day.) If baby bottles are not at hand, milk can be spoon-fed to an infant.

Especially during a war crisis, the best and most dependable food for an infant is mother's milk—provided the mother is assured an adequate diet. The possibility of disaster is one more reason

why a mother should nurse her baby for a full year. Storing additional high-protein foods and fats for a nursing mother usually will be better insurance against her infant getting sick or starving than keeping adequate stocks of baby foods and the equipment necessary for sanitary feeding after evacuation or an attack.

To give a daily vitamin supplement to a baby, a multivitamin pill should be crushed to a fine powder between two spoons and dissolved in a small amount of fluid, so that the baby can easily swallow it. If an infant does not receive adequate amounts of vitamins A, D, and C, he will develop deficiency symptoms in 1 to 3 months, depending on the amounts stored in his body. Vitamin C deficiency, the first to appear, can be prevented by giving an infant 15 mg of vitamin C each day (about $\frac{1}{3}$ of a 50-mg vitamin C tablet, pulverized) or customary foods containing vitamin C, such as orange juice. Lacking these sources, the juice squeezed from sprouted grains or legumes can be used. If no vitamin pills or foods rich in vitamin D are available, exposure of the baby's skin to sunlight will cause his body to produce vitamin D. It would be wise to wait about 30 days after an attack before exposing the baby to sunlight. After that, short exposures would be safe except in areas of extremely heavy fallout. As a further precaution, the baby can be placed in an open, shallow pit that will provide shielding from radiation given off by fallout particles on the ground. Initial exposure should be very short, no more than 10 minutes.

If sufficient milk is not obtainable, even infants younger than six months should be given solid food. Solid foods for babies must be pureed to a fine

Table 9.4. Emergency food supply for one baby.

Ingredients	Per Day		Per Month		Per 6 Months	
	Volumes and Ounces	Grams	Pounds	Kilograms	Pounds	Kilograms
Instant non-fat dry milk	1 cup + 2 tablespoons ($2\frac{1}{4}$ oz)	8	6	2.72	32	15
Vegetable cooking oil	3 tablespoons (1 oz)	30	2	0.90	12	5.5
Sugar	2 tablespoons (0.7 oz)	20	1.3	0.60	8	3.6
Standard daily multi-vitamin pills	$\frac{1}{3}$ pill			10 pills		60 pills

texture. Using a modern baby food grinder makes pureeing quick and easy work. Under crisis conditions, a grinder should be cleaned and disinfected like other baby-feeding utensils, as described later in this section.

Several expedient methods are available: the food can be pressed through a sieve, mashed with a fork or spoon, or squeezed through a porous cloth. Good sanitation must be maintained; all foods should be brought to a boil after pureeing to insure that the food is safe from bacteria.

A pureed solid baby food can be made by first boiling together 3 parts of a cereal grain and 1 part of beans until they are soft. Then the mixture should be pressed through a sieve. The sieve catches the tough hulls from the grain kernels and the skins from the beans. The grain-beans combination will provide needed calories and a well-supplemented protein. The beans also supply the additional iron that a baby needs by the time he is 6 months old. Flours made from whole grains or beans, as previously described, also can be used; however, these may contain more rough material.

Some grains are preferable to others. It is easier to sieve cooked corn kernels than cooked wheat kernels. Since wheat is the grain most likely to cause allergies, it should not be fed to an infant until he is 6 to 7 months old if other grains, such as rice or corn, are available.

Small children also need more protein than can be supplied by grains alone. As a substitute for milk, some bean food should be provided at every meal. If the available diet is deficient in a concentrated energy source such as fat or sugar, a child's feedings should be increased to 4 or 5 times a day, to enable him to assimilate more. Whenever possible, a small child should have a daily diet that contains at least one ounce of fat (3 tablespoons, without scraping the spoon). This would provide more than 10% of a young child's calories in the form of fat, which would be beneficial.

If under emergency conditions it is not practical to boil infant feeding utensils, they can be sterilized with a bleach solution. Add one teaspoon of ordinary household bleach to a quart of water. (Ordinary household bleach contains 5.25% sodium hypochlorite as its only active ingredient and supplies approximately 5% available chlorine. If the strength

of the bleach is unknown, add 3 teaspoons per quart.) Directions for safe feeding without boiling follow:

The Utensils (Include at least one 1-quart and one 1-pint mason jar, for keeping prepared formula sterile until used.)

1. Immediately after feeding, wash the inside and outside of all utensils used to prepare the formula and to feed the infant.
2. Fill a covered container with clean, cold water and add the appropriate amount of chlorine bleach.
3. Totally immerse all utensils until the next feeding (3 or 4 hours). Be sure that the bottle, if used, is filled with bleach solution. Keep container covered.

At Feeding Time

1. Wash hands before preparing food.
2. Remove utensils from the disinfectant chlorine solution and drain, but do not rinse or dry.
3. Prepare formula; feed the baby.
4. Immediately after feeding, wash utensils in clean water and immerse again in the disinfectant solution.
5. Prepare fresh chlorine solution each day.

STORAGE OF FOODS

Whole grains and white sugar can be stored successfully for decades; dried beans, non-fat milk powder, and vegetable oil can be stored for several years. Some rules for good storage follow:

• **Keep food dry.** The most dependable way to assure continuing dryness is to store dry grain in metal containers, such as ordinary 5-gallon metal storage cans or 55-gallon metal drums with gasketed lids. Filled 5-gallon cans are light enough to be easily carried in an automobile when evacuating.

Particularly in humid areas, grain which seems to be dry often is not dry enough to store for a long period. To be sure that grain is dry enough to store for years, use a drying agent. The best drying agent for this purpose is silica gel with color indicator. The gel is blue when it is capable of absorbing water and pink when it needs to be heated to become an

effective drying agent again. Silica gel is inexpensive if bought from chemical supply firms located in most cities. By heating it in a hot oven or in a can over a fire until it turns blue again, silica gel can be used repeatedly for years.

The best containers for the silica gel used to dry grain (or to determine its dryness) are homemade cloth envelopes large enough for a heaping cupful of the gel. A clear plastic window should be stitched in, through which color changes can be observed. Put an envelope of silica gel on top of the grain in a 5-gallon can filled to within a couple of inches of its top. Then close the can tightly. Even a rather loose-fitting lid can be sealed tightly with tape. If after a few days the silica gel is still blue, the grain is dry enough. If the silica gel has turned pink, repeat the process with fresh envelopes until it can be seen that the grain is dry.

● **Keep grains and beans free of weevils, other insects, and rodents.** Dry ice (carbon dioxide) is the safest means still widely available to the public for ridding grain and beans of insects. Place about 4 inches of dry ice on top of the grain in a 5-gallon metal container. Put the lid on somewhat loosely, so that air in the grain can be driven out of the can. (This will happen as the dry ice vaporizes and the heavy carbon dioxide gas sinks into the grain and displaces the air around the kernels.) After an hour or two, tighten the lid and seal it with tape. After one month, all insects in this carbon-dioxide atmosphere will have died from lack of oxygen.

● **Store foods in the coolest available place, out of the light.** Remember that the storage life of most foods is cut in half by an increase of 18° F (10° C) in storage temperature.³⁰ Thus 48 months of storage at 52° F is equivalent to 24 months at 70° F, and to 12 months at 88° F.

Illustrative of the importance of cool storage are my experiences in storing non-fat milk powder in an earth-covered, cool shelter. In steel drums I stored unopened 100-pound bags of compact, non-fat milk powder that I bought from bakeries. The cost per pound was much less than I would have paid for the largest packages sold in supermarkets. After 7 years storage at temperatures of about 50° F the year around, my milk powder was still good — as good as it would have been if stored in a normally air-conditioned and heated home for about 3 years.

● **Do not place stored metal containers directly on the floor.** To avoid possible condensation of moisture and the rusting that results, place containers on spaced boards. For long-term storage in damp permanent shelters or damp basements, use solid-plastic containers with thick walls.

● **Rotate stored foods.** Eat the oldest food of each type and replace it with fresh food. Although cooking oil and non-fat milk powder remain edible after several years of storage at room temperature, these and most other dry foods are more nourishing and taste better if stored for no more than 2 years. Most canned foods taste better if kept no more than one year. Exceptions are whole grains and white sugar, which stay good for decades if stored properly.

● **Store plenty of salt.** In our modern world salt is so abundant and cheap that most Americans do not realize that in many areas soon after a major nuclear attack salt would become a hard-to-get essential nutrient. Persons working hard without salt would suffer cramps and feel exhausted within a few days. Most famine relief shipments of grain probably would not include salt. So store enough salt both to salt your family's food for months and to trade for other necessities.

SEEDS

For thousands of years storing seeds has been an essential part of the survival preparations made by millions of prudent people fearing attack. Seeds are hopes for future food and the defeat of famine, that lethal follower of disastrous wars.

Among the most impressive sounds I ever heard were faint, distant rattles of small stones, heard on a quiet, black, freezing night in 1944. An air raid was expected before dawn. I was standing on one of the bare hills outside Kunming, China, trying to pinpoint the sources of lights that Japanese agents had used just before previous air raids to guide attacking bombers to blacked-out Kunming. Puzzled by sounds of cautious digging starting at about 2:00 AM, I asked my interpreter if he knew what was going on. He told me that farmers walked most of the night to make sure that no one was following them, and were burying sealed jars of seeds in secret places, far enough from homes

so that probably no one would hear them digging. My interpreter did not need to tell me that if the advancing Japanese troops succeeded in taking Kunming they would ruthlessly strip the surrounding countryside of all food they could find. Then those prudent farmers would have seeds and hope in a starving land.

If you doubt that enough of our current "oversupply" of stored whole grains, soybeans, milk powder, etc. would reach you after a nuclear attack, you should store seeds known to grow well in your area.

When getting your supply of survival seeds, remember:

- Grains and beans are the best plant sources of energy and protein.

- Even if you have enough vitamins for several months, you may not be able to buy more until long after a nuclear war.

- The deadly curses of scurvy, vitamin A deficiencies, and pellagra can be prevented by eating the plants, seeds, and sprouted seeds described earlier in this chapter.

- Plants grown from hybrid seeds give larger yields, but do not produce as productive seeds as do plants grown from good non-hybrid seeds.

- Seeds of proven productivity in your locality may be more valuable than money after a major nuclear attack.

- You should get and store mostly non-hybrid seeds, after learning from experienced local gardeners which are best.