

Version 2.50  
Updated October 1997  
Supersedes Ver 2.10

## PRUDENT FOOD STORAGE: Questions and Answers.

From the House at Cat's Green  
Alan T. Hagan

"In this work, when it shall be found that much is omitted,  
let it not be forgotten that much likewise is performed."

Samuel Johnson, 1775, upon  
completion of his dictionary.  
Courtesy of James T. Stevens

### FOREWORD

This work is a compilation of answers to frequently asked questions (FAQ) concerning long term food storage. Its purpose is to promote an understanding of the concepts, methods and techniques of long term food storage.

There is commonality between food storage and food preservation even though they are not precisely the same thing. Some of the information here may be found in greater or lesser detail in one of the nine sections of the rec.food.preserving (r.f.p.) FAQ compiled by Leslie Basel. If you want the how to's of drying fruit, making jerky, canning beans, fermenting pickles or corning beef then I refer you to her work and the good stuff to be found there.

I will delve a bit more deeply than Leslie into the ins and outs of how to put away your storage foods and have a reasonable expectation of getting something edible back out of the container when you finally do use it. Also covered will be food spoilage -- how to recognize it and how to combat it. A resource list of where to find supplies and in-depth information will be included at the end.

This file is updated as sufficient relevant information becomes available, at this time on a semi-annual basis with updates coming out in April and October. Be of assistance -- point out mistakes, write sections and reviews, provide us with new sources. All contributors, if you wish, will be cited in this file.

ACKNOWLEDGEMENTS: Diana J. Hagan, my wife, for a \*lot\* of valuable assistance; Susan Collingwood for sage advice; Al Durtschi for resources and encouragement; Sandon A. Flowers; Mark Westphal; Pyotr Filipovich; Denis DeFigueiredo; Jenny S. Johanssen; Woody Harper; Higgins10; Kahless; Amy Thompson(Saco Foods); Geri Guidetti; Logan VanLeigh; Amy Gale, editor of the rec.food.cooking FAQ; James T.

Stevens, author of \*Making The Best of Basics\*; Craig Ellis; a number of folks who for reasons sufficient unto themselves wish to remain anonymous and last, but certainly not least, Leslie Basel, without whom I'd never have attempted this in the first place.

Updated: 9/18/96; 4/16/97; 7/21/97; 10/20/97

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I -- SHELF LIVES: TIME, TEMPERATURE, MOISTURE AND LIGHT.

Since the entire idea of a food storage program is that it should be available for you and yours in times of need, it is desirable to gain an understanding of those conditions that can affect the edibles stored in your pantry.

Your storage program is only as good as the original quality of the food that goes into it. It cannot get any better than what originally goes in, but it can certainly get worse. In the fullness of time, all stored foods will degrade in nutrient content and palatability until they reach the inevitable end where even the dog won't eat them. It's because of this eventuality that every article, book, and teacher concerned with putting food by gives the same advice: date all food containers and rotate, Rotate, ROTATE.

It is important to remember when discussing the usefulness of various foodstuffs that there are really \*two\* shelf lives to be considered. The first shelf life is the nutrient content of the food. This actually begins to degrade from the moment the food is harvested. Three factors dictate nutritional shelf life: the food's initial nutritional content; the processing steps the food underwent before it was placed into storage, and its storage conditions. Eventually the nutrition will dwindle away to nothing. At some point it will have to be decided the remaining nutrition is not worth the space the food is taking up and it should be rotated out of storage.

The second shelf life to consider is a food's useful life or the point at which it undergoes undesirable changes to taste, texture, color and cooking qualities. This is the reason for the "use by" dates on many foods and for shelf lives in general and will almost always be in excess of good nutritive life. We've all heard of people eating many year old preserved foods such as jellies, MRE's and the like. If you don't have anything to replace it with, it's not necessary to throw food out just because it's reached the end of its nutritive shelf life. Do, however, keep in mind that increasing age will only further decrease the useful nutrition and increase the likelihood that something may cause the food to spoil.

Within reason, the key to prolonging the storage life of your edibles lies in lowering the temperature of the area in which they are stored. The storage lives of most foods are cut in half by every increase of 18 F (10 degrees Celsius). For example, if you've stored your food in a garage that has a temperature of 90 F then you should expect a shelf life less than half of what could be obtained at room temperature (70 F) which in turn is less than half the storage life that you could get if you kept them in your refrigerator at 40 F. Your storage area should be located where the temperature can be kept above freezing (32 F) and, if possible, below 72 F.

Ideally, your storage location should have a humidity level of 15% or less, but unless you live in the desert it's not terribly likely you'll be able to achieve this so you'll have to do the best that you can. Regardless, moisture is not good for your stored edibles so you want to minimize it as much as possible. This can be done by several methods. The first is to keep your storage location air-conditioned during the warm and humid times of the year. The second is to package the goods in storage containers impervious to moisture and then to deal with the moisture trapped inside. If you can, there's no reason not to use both. All storage containers should be kept off the floor and out of direct contact from exterior walls to reduce the chances of condensation.

Once you've gotten temperature and humidity under control, it's necessary to look at light. Light is a form of energy and when it shines on your stored foods long enough it transfers some of that energy to the food. That energy has the effect of degrading its nutritional content and appearance. Fat soluble vitamins, such as A,D and E are particularly sensitive to light degradation. It's a pretty sight to look at rows and rows of jars full of delicious food, particularly if you were the one that put the food in those jars. However, if you want to keep them at their best, you'll admire them only when you turn the light on in the pantry to retrieve a jar. If you don't have a room that can be dedicated to this purpose then store the jars in the cardboard box they came in. This will protect them not only from light, but help to cushion them from shocks which might break a jar or cause it to lose its seal. For those of you in earthquake country, it's a particularly good idea. When "terra" is no longer "firma" your jars just might dance right off onto the floor.

Assuming that it was properly processed in the first place, canned, dried and frozen (never thawed) foods do not become unsafe when stored longer than the recommended time, but their nutrient quality fades and their flavor goes downhill. Think of rotating your food storage as paying your food insurance premiums -- slacking off on rotation cuts back on your coverage. Is your food insurance up to date?

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## II -- THE TECHNIQUES OF FOOD STORAGE

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### A. GRAINS AND LEGUMES

#### A.1 GRAIN VARIETIES

One of the most important decisions in planning your long term food storage are the kinds of grains you are going to store. Too many people do not give this adequate thought, and just buy however much wheat they think is necessary to meet their needs and leave it at that. Others rely upon pre-packaged plans made for them by the storage food retailer who put together the food package they've purchased. For many, either decision could be a major mistake.

There are any number of food storage plans to be found by those who take the time to look. Many of them are based on the so-called "Mormon Four" of wheat, milk, honey and salt, with as many additional foods as

the planner finds to be desirable. Back in the thirties, when I believe this plan first got its start, this may have been OK, but we've learned a great deal since then. An unfortunate number of people in our society have developed allergies to one kind of food or another. One of the more common food allergens is wheat. Even more unfortunate is the fact that of those with an allergy to this most common of grains, many of them are not even aware of it. They won't become aware of it until they try to live with wheat as a large part of their diet. This is the reason you should store what you eat and eat what you store: So that ugly surprises such as this don't come up when it's too late to easily avoid them.

A second reason to think about providing a variety of grains in your food storage is appetite fatigue. There are many people who think providing variety in the diet is relatively unimportant and that if and when the time comes they'll eat what they've got and that will be that. For healthy, well-adjusted adults under ordinary circumstances this might be possible without too much difficulty. However, the entire reason for having a \*long term\* food storage program is for when circumstances \*aren't\* ordinary. Times of crisis produce stress -- possibly physical, but always mental. If you are suddenly forced to eat a diet that is both alien and monotonous, it is going to add just that much more stress on top of what you are already dealing with. If your planning includes the elderly, young children and infants they might just quit eating or refuse to eat sufficient amounts and become unable to survive. This is not a trivial problem and should be given serious consideration. Consider the positive aspects of adding some "comfort foods".

In his book, \*Making the Best of Basics\*, James Stevens mentions a post WWII study by Dr. Norman Wright, of the British Food Ministry, which found that people in England and Europe were more likely to reject unfamiliar or distasteful foods during times of stress than under normal conditions. When it's wheat, day in and day out, then wheat's going to start becoming distasteful pretty fast. Far better to have a variety of foods on hand to forestall appetite fatigue and, more importantly, to use those storable foods in your everyday diet so that you'll be accustomed to them.

[If anyone knows where I may find an actual copy of the study by Dr. Wright, I'd appreciate it if you'd point me to it. Thanks-ed.]

Below is a list of some common and uncommon grains presently available in the marketplace. Because wheat is by far the most common directly consumed grain in the United States I've put it at the head of the list.

**WHEAT:** Wheat comes in a number of different varieties. Each variety is more or less suitable for a given purpose based on its characteristics. The most common classifications for wheat varieties are spring or winter, hard or soft, red or white.

The hard wheats have kernels that tend to be small, very hard and have a high gluten content. Gluten is the protein in grains that enables the dough made from them to trap the gasses produced by yeast fermentation and raise the bread. Low gluten wheat does not produce as

good a loaf as high gluten wheat, though they can still be used for yeast breads if necessary. As a general rule, hard varieties have more protein than soft varieties.

The soft varieties have kernels tending to be larger, plumper and softer in texture than hard wheats. Their gluten content is less and these are used in pastries, quick breads, pastas, and breakfast cereals.

Winter wheats are planted in the fall, over winter in the field and are harvested the next summer. Spring wheats are planted in the early spring and are harvested in the fall. Red wheats comprise most of the hard varieties while white wheats comprise most of the soft. Recently, hard white wheats have been developed that are suitable for raised bread making. Some feel the hard white varieties make a better tasting whole wheat bread than the hard red.

The most commonly stored are the hard red varieties, either spring or winter, because of their high protein. They should have a protein content of no less than 12%, with higher the better. The hard white spring wheats are still relatively new and are not yet widespread. They have the same excellent storage characteristics as the hard red wheats.

**AMARANTH:** Amaranth is not a true cereal grain at all, but is a relative of the pigweeds and the ornamental flowers we know as cockscomb. It's grown not only for its seeds, but for its leaves that can be cooked and eaten as greens. The grain is high in protein, particularly the amino acid lysine which is limited in the true cereal grains. The grains can be milled as-is, or the seeds can be toasted to provide more flavor. The flour lacks gluten, so it's not suited for raised breads, but can be made into any of a number of flat breads. Some varieties can be popped much like popcorn, or can be boiled and eaten as a cereal, used in soups, granolas, and the like. Toasted or untoasted, it blends well with other grain flours.

**BARLEY:** Barley is thought by some to be the first grain ever grown by man. It has short, stubby kernels with a hull that is difficult to remove. Excluding barley intended for malting or animal feed, most of this grain is consumed by humans in two forms. The most common is the white, highly processed "pearl" barley that has had most of its bran and germ milled off along with its hull. It is the least nutritious form of barley. The second form it's found in is called "pot" or "hulled" barley and it has been subjected to the same milling process as pearled, but with fewer trips through the polisher. Because of this, it retains more of the nutritious germ and bran. Unless you are prepared to try to get the hulls off I don't recommend buying barley still in the hull. Barley can be milled into flour, but its low gluten content will not make a good loaf of raised bread. It can be combined with other flours that have sufficient gluten to make good raised bread or used in flat breads. Barley flour and flakes have a light nutty flavor that is enhanced by toasting. Whole barley is commonly used to add thickness to soups and stews.

Recently, a hull-less form of barley has become available on the market through a few suppliers. This is whole grain barley with all of its bran and germ intact and should have the most nutrients of any form

of this grain available. I have not been able to discover yet how suitable it is for long term storage.

BUCKWHEAT: Buckwheat is another of those seeds commonly considered to be a grain, but which is not a true cereal. It is a close relative to the docks and sorrels. The grain itself is a dark, three cornered seed resembling a tiny beechnut. It has a hard, fibrous hull that requires a special buckwheat huller to remove it. Here in the U.S., it is most often used in pancakes, biscuits and muffins. In eastern Europe and Russia it is known in its toasted form as kasha. In the Far East, it's often made into soba or noodles. It's also a good bee plant, producing a dark, strongly flavored honey. The flour is light or dark depending on how much of the hull has been removed before grinding. Dark flour is far superior nutritionally as you might expect, but it also much more strongly flavored. Buckwheat is one of those foods with no middle ground in peoples opinions -- they either love it or they hate it. Like amaranth, it's high in lysine, an amino acid commonly lacking in the true cereal grains.

CORN (MAIZE): Corn is the most common grain crop in the U.S., but it is mostly consumed indirectly as animal feed or even industrial feedstock rather than directly as food. Nevertheless, it comes in an amazing variety of forms and, like wheat, some of them are better suited for a particular purpose than others. The varieties intended to be eaten as fresh, green corn are very high in sugar content and do not dry or store well. The other varieties are the flint, dent, and popcorns. All of them keep well when they have been properly dried. To a certain extent, they're all interchangeable for purposes of grinding into meal (sometimes known as polenta meal) or flour (very finely ground corn, not cornstarch), but some make better meal than flour and vice versa. As a general rule of thumb, the flint varieties make better meal as they have a grittier texture than the dent corns which make better flour. If meal, hominy and hominy grits (commonly called just "grits") are what you are most interested in, use the flint type. If you intend to make corn masa for tortillas and tamales, then the dent type is what you want. Popcorn is what you need if you want to pop it for snacks and it can also be ground into meal or flour. It seems to me it makes a very good meal, but it's just a bit gritty for flour. Your mileage may vary. Yellow dent corn seems to be the most commonly available variety among storage food dealers.

Popcorn is one form of a whole grain available to nearly everyone in the U.S. if they know where to look. Since it's so popular as a snack food, particularly in movie theaters and events like fairs and ball games, even the smallest of towns will generally have at least one business selling it in twenty five or fifty pound bags. Since it's meant to be eaten it's safe for food. To be at its most poppable, this corn needs to have a moisture content between 13.5%-15.5% which makes it just a little too moist for ideal storage. A small amount of drying will need to be done before it's packed away. If wanted for popping later, it can always be re-hydrated by sprinkling a small amount of water on the kernels, shaking vigorously and allowing it to be absorbed.

Once you've decided between flint, dent or popcorn, you now have to decide upon it's color: There are yellow, white, blue, & red dried

varieties. The yellow and white types are the most common by far with the blues and reds mostly being relegated to curiosities, though blue corn has been gaining in popularity these last few years. It should be kept in mind that white corn does not have the carotene (converts into vitamin A) content of yellow corn. Since vitamin A is one of the major limiting vitamins in long term food storage, any possible source of it should be utilized so for this reason I suggest storing yellow rather than white corn. Additionally, much of the niacin content of corn is chemically bound up in a form not available for human nutrition unless it has been treated with an alkali. If grits, hominy or corn masa (for tortillas and tamales) are not a part of your diet and you're storing corn, it is a very good idea to begin to develop a taste for some or all of these alkali treated forms of corn foods.

MILLET: Millet is an important staple grain in North China, and India, but is little known as a food in the U.S., mostly being used as bird feed. The grain kernels are very small, round, and usually ivory colored or yellow, though some varieties are darker. The lack of gluten and a rather bland flavor may account for the anonymity of this grain here, but it's alkaline content is higher than other grains and makes it very easy to digest. It also has a higher iron content than any other grain but amaranth. It swells a great deal when cooked and supplies more servings per pound than any other grains. When cooked like rice it makes an excellent breakfast cereal. Though it has little gluten of its own, it mixes well with other flours.

OATS: Though the Scots and the Irish have made an entire cuisine from oats, they are still mostly thought of in the U.S. as a bland breakfast food. It is seldom found as a whole grain, usually being sold processed in one form or another. Much like barley, oats are a difficult grain to separate from their hulls. Besides their longtime role as a breakfast food, where they can be made very flavorful with a little creative thought, oats make an excellent thickener of soups and stews and a filler in meat loafs and casseroles. Probably the second most common use for oats in America is in cookies and granolas.

Listed below in order of desirability for storage are the forms of oats most often found in this country. Rolled and cut oats retain both their bran and their germ.

Oat groats: These are whole oats with the hulls removed. They are not often found in this form, but can sometimes be had from natural food stores and some storage food dealers. Oats are not the easiest thing to get a consistent grind from so producing your own oat flour takes a bit of experience.

Steel cut oats: Also known as Irish or pinhead or porridge (but so are rolled) oats. These are oat groats which have been cut into chunks with steel blades. They're not rolled and look like coarse bits of grain. This form can be found in both natural food stores (sometimes \*much\* cheaper) and many supermarkets.

Rolled oats: These are also commonly called "old fashioned", "thick cut" or "porridge" oats. To produce them, oat groats are steamed and then rolled to flatten. They can generally be found wherever oats are

sold. They take longer to cook than do the quick cooking oats, but they retain more flavor and nutrition. This is what most people will call to mind when they think of oatmeal.

Quick cooking rolled oats: These are just steamed oat groats rolled thinner than the old fashioned kind above so that they will cook faster. They can usually be found right next to the thicker rolled oats.

Instant rolled oats: These are the "just add hot water" or microwave type of oat cereals and are not at all suited for a long term food storage program. They do, however, have uses in "bug out" and 72 hour food kits for short term crises.

Whole oats: This is with the hulls still on. They are sold in seed stores and sometimes straight from the farmer who grew them. Unless you have some means of getting the hulls off, I don't recommend buying oats in this form. If you do buy from a seed supplier, make certain that they have not been treated with any chemicals that are toxic to humans.

QUINOA: Quinoa is yet another of the grains that is not a true cereal. Its botanical name is Chenopodium quinoa (pronounced "keen-wah"), and is a relative of the common weed Lambsquarter. The individual kernels are about 1.5-2 mm in size and are shaped rather like small flattened spheres, yellow in color. When quinoa is cooked, the germ of the grain coils into a small "tail" that lends a pleasant crunch. This exotic grain should be thoroughly washed before cooking in order to prevent the cooked product from tasting bitter. There are several varieties of quinoa that have color ranging from near white to a dark brown. The larger white varieties are considered superior and are the most common found.

RICES: Rice is the most commonly consumed food grain in the world. The U.S. is the leading exporter of it, though we actually only produce about 1% of the global supply. It is my favorite grain and in the form of brown rice, we eat a great deal of it here at the House.

Much like wheat and corn, rice comes in a number of varieties, each with different characteristics. They are typically divided into classes by the length of their kernel grains; short, medium and long.

Short grain rice: Short grain rice is a little softer and bit moister when it cooks and tends to stick together more than the longer rices. It has a sweeter, somewhat stronger flavor than long grain rice.

Medium grain rice: Medium grain rice is not very common in the States. It has flavor like short grain rice, but with a texture more like long grain rice.

Long grain rice: Long grain rice cooks up into a dryer, flakier dish than the shorter grains and the flavor tends to be blander. It is the most commonly found size of rice on the grocery shelves.

Each of these may be processed into brown, white, parboiled or converted and instant rices. Below is a short discussion of the

differences between the various types of rices.

Brown rice: This is whole grain rice with only the hull removed. It retains all of the nutrition to be found in rice and has a pleasant nutty flavor when boiled. From a nutrition standpoint it is by far the best of the rices to put into storage, but it has one flaw: The essential oil in the germ of the rice is very susceptible to oxidation and soon goes rancid. As a result, brown rice has a shelf life of only about six months from the date of purchase unless given special packaging or storage processing. Freezing or refrigeration will greatly extend its storage life. It's also possible to purchase brown rice from long term food suppliers specially packaged in air tight containers with an inert nitrogen atmosphere. In this kind of packaging, (if properly done), the storage life of brown rice can be extended for years.

Converted rice: Converted rice starts as brown rice which undergoes a process of soaking and steaming until it is partially cooked. It is dried and then polished to remove the bran and germ. The steaming process drives some of the vitamins and minerals from the outer layers into the white inner layers. This makes it more nutritious than polished white rice, but also makes it more expensive.

White rice: This is raw rice that has had its outer layers milled off, taking with it about 10% of its protein, 85% of its fat and 70% of its mineral content. Because so much of the nutrition of the rice is lost, white rice sold in this country has to be enriched with vitamins that only partially replaces what was removed.

RYE: Rye is a well known bread grain in the U.S., though not as popular as wheat. It has dark brown kernels longer and thinner than wheat, but less gluten. Bread made from this grain tends to be somewhat dense unless gluten is added (often in the form of a lot of wheat flour) with color that ranges from pale to dark brown. German pumpernickel, made with unrefined rye flour and molasses, is the blackest, densest form. Rye makes for excellent variety in the diet.

SORGHUM: Sorghum is probably more widely known here in the States for the syrup made from the juice squeezed from the canes of one of its many varieties. Also widely called "milo", it is one of the principle cereal grains grown in Africa. Its seeds are somewhat round, a little smaller than peppercorns, with an overall brown color with a bit of red and yellow mixed in. The varieties called "yellow endosperm sorghum" have a better taste. Sorghum is a major feed grain in the Southwestern part of the U.S. and is where the vast majority of the national milo production goes to. Like most of the other grains, sorghum is low in gluten, but the seeds can be milled into flour and mixed with higher gluten flours or made into flat breads, pancakes or cookies. In the Far East, it is cooked and eaten like rice, while in Africa it is ground in meal for porridge. It's also commonly brewed into alcoholic beverages.

TRITICALE: Triticale is not a creation sprung whole from the foreheads of Star Trek script writers. It is, in fact, a cross or hybrid between wheat and rye. This youngest grain combines the

productivity of wheat with the ruggedness of rye and has a high nutrition value. Triticale kernels are gray-brown, oval shaped larger-than-wheat kernels and plumper than rye. It will make a raised bread like wheat flour will, but the gluten is a bit weak so wheat flour is frequently added to strengthen it. Because of the delicate nature of its gluten, excessive kneading must be avoided. This grain can be used in much the same way wheat or rye is. Although it is the youngest of the grains, it's been around for some years now. For reasons I've never understood, triticale has never achieved much popularity. Whether this is for reasons of agricultural production or public acceptance I don't know.

#### A.2 LEGUME VARIETIES

Unless a person is willing to spend a great deal of money on preserved meats, a food storage program not including a quantity of legumes is simply incomplete. There are few non-animal foods that contain the amount of protein to be found in dried beans, peas, and lentils. The varieties commonly available in this country have protein contents ranging from 20%-35%. As with most non-animal proteins, they are not complete in themselves for purposes of human nutrition, but become so when they are combined with the incomplete proteins found in grains. It is for this reason that grains and legumes are so often mentioned together. In cultures all over the world, it is common to find the two served together at a meal, making a complete protein, even when those doing the serving have no understanding of nutrition at all.

The legume family, of which all beans, peas, lentils, and peanuts are a part of, is one of the largest in the plant kingdom. Because of this and the many thousands of years of development and cultivation that man has given them, the variety of edible legumes available to us is huge. Both the appearance and the names of legume varieties are colorful and varied. The names range from "adzuki" beans, a type of soybean from the Orient, to "zipper" peas, a commonly found field pea here in the Southern U.S. The color of the beans can range from a clean white, to deep red, dull green to flat black with thousands of mixtures and patterns of colors.

In spite of this incredible variety of names and colors, legumes are largely interchangeable in cooking usage, although some dishes just wouldn't be the same if a different type was used. Below is a partial list of some of the more commonly eaten bean varieties here in the U.S.

**BLACK BEAN:** Also known as turtle beans, these small, dark-brownish black, oval-shaped beans are well known in Cuban black bean soup. They are very commonly used in Central and South America and in China. They tend to bleed very darkly when cooked so they are not well suited to being combined with other beans, lest they give the entire pot a muddy appearance.

**BLACK-EYED PEA:** Although there is tremendous variation among the many varieties of field peas eaten throughout the Southern United States, it is black-eyed peas that are the most commonly known nationwide. The coloring of field peas is as varied as the rest of the legume family, with black-eyed peas being small and oval-shaped with an overall creamy color and, of course, their distinctive black-eye. Dried

field peas cook very quickly and combine very tastily with either rice or cornbread.

CHICKPEA: Also known as the garbanzo bean or cecci pea (or bean), it tends to be a creamy or tan color, rather lumpy roundish and larger than dried garden peas. Many have eaten chickpeas, even if they've never seen a whole one. They are the prime ingredient in hummus and falafel and are one of the oldest cultivated legume species known, going back as far as 5400 B.C. in the Near East.

KIDNEY BEANS: Just like the rest of the family, kidney beans can be found in wide variety. They come in both light and dark red color in their distinctive kidney shape. Probably best known here in the U.S. for their use in chili, they figure prominently in Mexican, Brazilian and Chinese cuisine.

LENTILS: Lentils are an odd lot. They don't fit in with either the beans or the peas and occupy a place by themselves. Their shape is different from the other legumes being roundish little discs with colors ranging from muddy brown, to green to a rather bright orangish-red. They cook very quickly compared to the larger beans and have a distinctive flavor. They are much used in Far Eastern cuisine from Indian to Chinese.

LIMA BEANS: In the Southern U.S., they are also commonly called butter beans. They are one of the most common beans found in this country in all manner of preservation from the young small beans to the large fully mature type. Their flavor is pleasant, but a little bland. Their shape is rather flat and broad with colors ranging from pale green to speckled cream and purple.

PEANUTS: The peanut, commonly known outside the U.S. as the groundnut, is not actually a nut at all, but a legume. Peanuts are another odd species not much like the more familiar beans and peas. Whatever their classification they are certainly not unfamiliar to U.S. eaters. Peanuts have a high protein percentage and even more fat. They are one of the two legume species commonly grown for oilseed in this country, and are also used for peanut butter, boiled and roasted peanuts. Many Central and South American, African and Chinese dishes incorporate peanuts so they are useful for much more than just a snack food or cooking oil.

PINTO BEANS: Anyone who has eaten Tex-Mex food has probably had the pinto bean. It is one of the most commonly eaten beans in the U.S., particularly in the Southwestern portion of the country. Stereotypically bean shaped, it has a dappled pattern of tans and browns on its shell. Pintos have a flavor that blends well with many foods. When ground together with white or navy beans they make my favorite home-made version of falafel.

SOYBEANS: An entire university could be founded on the culinary and industrial uses of the soybean. It is by far the legume with the highest protein content in commercial production as well as being the other legume oilseed producer alongside the peanut. The beans themselves are small, and round with a multitude of different shades. Although the U.S. grows a very large percentage of the global supply of these beans, we actually consume virtually none of them directly. Most

of them go into cattle feed, are used by industry or exported. What does get eaten directly has usually been processed in some form or fashion. Soybean products range from tofu, to tempeh, to textured vegetable protein and hundreds of other uses. Although they are very high in protein, they don't lend themselves well to just being boiled until done and eaten the way other beans and peas do. For this reason, if you plan on keeping some as a part of your storage program (and you should) you would be well served to begin to learn how to process and prepare them \*now\* when you're not under pressure to produce. That way you can throw out your mistakes and order pizza, rather than having to choke them down, regardless.

#### A.3 TYPES OF AVAILABILITY OF GRAINS AND LEGUMES

Grains and legumes of all types may be purchased in a number of different fashions depending largely on where you live and the time of year. If you should happen to live in the area where the type of grain or legume that you are interested in purchasing is grown you may be able to purchase direct from the producer or distributor.

If you are interested in doing this, you may be able to find what you want at any processing step along the way. The most basic form is called "field run" which means that it's been harvested and sold shortly thereafter. It will not have been given any cleaning or processing and is likely to be rather dirty depending upon the conditions under which it was grown and harvested.

A second basic form called "field run from storage" is grain that has been harvested and then put into storage for a time. It will have all of the dirt and detritus of field run grain and whatever it may have picked up from the silo as well.

If you want cleaner grain you should look for "pre-cleaned" which means that it has been passed through fans, screens or sieves to remove chaff, smut balls, insect parts, mouse droppings and other debris.

For those of us who don't live in an area that produces the grain and legumes that we're interested in, we have to resort to the last type which is "pre-cleaned and pre-packaged". This is grain that's been harvested, cleaned and put up in bags or other containers-possibly even going so far as to already be packaged for long term storage.

Each of the above types of availability has its good and bad points. As you might expect, the more processing the product receives, the higher its price is likely to be. If you don't mind doing a little cleaning and you need to be frugal with your cash, then field run grain is the way to go.

**IMPORTANT NOTE:** If you have purchased your grains and legumes from a food store or a foods dealer then you needn't worry about hidden mold infections, fungicides or insecticides that are unsafe for human consumption. In the U.S. the products will have been checked at least several times by Federal and State agriculture dept's and probably by the major foods dealers as well, to insure its quality.

This is not \*necessarily\* the case when you purchase your grains or

legumes direct from the farmer or elevator operator as field run or field run from storage grain. Nor is it necessarily the case if you've made the decision to utilize grains marketed as animal feed. Inspection procedures vary from nation to nation, so outside of the U.S. inquire of your supplier.

If you are buying your grains and legumes from some-place other than a food store then you need to know the history of what it is you are buying. Straight field run grain, other than being dirty, is not likely to have had anything added to it that would make it undesirable for human consumption. There is, however, the small possibility it may have been infected with molds that would make it unsafe for eating. Field run from storage and any grade of grain not specifically advertised for human consumption may have had fumigants, fungicides or insecticides not certified as safe for human foods added to it while it was in the bin. It is important to know what it has been treated with before you buy it.

There is a fungal infection of grain called "ergot". It is attracted to rye more so than other grains, particularly if the growing conditions were damp where it was grown. This fungus causes a nervous disorder known as St. Anthony's Fire. When eaten in large quantities the ergot alkaloids can cause constriction of the blood vessels, particularly in the extremities. The effects of ergot poisoning are cumulative and lead to numbness of the limbs and other, frequently serious symptoms.

This fungal disease affects only the flowering parts of some members of the grass family, mostly rye. The fungus bodies are hard, spur like, purple black structures that replace the kernel in the grain head. The ergot bodies can vary in size from the length of the kernel to as much as several times as long. They don't crush as easily as smut bodies of other fungi. When they are cracked open, the inner broken faces are can be off-white, yellow, or tan. The infected grain looks very different from ordinary, healthy rye grains and can be spotted easily. Ergot only rarely affects other grains. If you purchase field run rye, you should closely examine it first for the presence of ergot bodies. If you find more than a very few, pass up that grain and look elsewhere.

Sometimes grain in the form of animal feed or seed grain/legumes is available. Keep in mind animal feeds may have a higher contaminant level than what is permissible for human consumption. Under certain circumstances, the USDA allows the sale of grain or legumes for animal feed that could not be sold for direct human consumption. If that feed is to be fed to non-lactating (non-dairy animals), they will sometimes allow an aflatoxin (a type of fungal mycotoxin) content of five times what is permissible for use in human foodstuffs. It may even be mixed varieties of one grain and not all one type. Seed grains, in particular, must be investigated carefully to find out what they may have been treated with. It is quite common for seed to have had fungicides applied to them, and maybe other chemicals as well.

If you do purchase field run grain of any sort, examine it closely for contamination and moldy grain. Ask the farmer or distributor whether it has been tested for mold or mycotoxin content. This is especially the case if you are buying field-run CORN, RYE, SOYBEANS or RICE. When you purchase direct from the field, you may be getting it before it has been checked. Be certain of what it is that you are

getting and ask questions if you choose to go this route. Know who you are dealing with. Unless you just can't find any other source, I don't recommend using animal feed or seed grains for human food.

Please see section III.B.3 "Molds In Grains and Legumes" for further information.

#### A.3.1 MOISTURE CONTENT

The moisture content of the grain or legume you want to purchase or grow has a major impact on how long you will be able to store it and have it remain nutritious and edible. Some of the information I have found says that grain with a moisture content as high as 12% can be safely put into long term storage, but there is a risk to storing grain at that moisture level that should be understood.

The outside of each and every kernel of grain or bean you buy or grow may host thousands of fungi spores and bacteria. This is all perfectly natural and is not a reason to panic. The problem lies in that at moisture levels between 13.5% to 15% some fungal species are able to grow and reproduce. Other species require a moisture level in the 16-23% range. Aerobic bacteria (oxygen using) require a moisture level of about 20%. Raw peanuts are particularly susceptible to Aspergillus mold growth that produces afltoxin and should be stored with an 8% moisture content or less.

Thus, if you have grain you want to store with a moisture content as high as 12% you are perilously close to having enough moisture to enable mold growth which could lead to the ruin of your grain. For this reason, I suggest keeping all grains and legumes to a moisture content of no more than 10%.

If you do not have a clue as to what the moisture level of your grain is here is a rough method to determine it.

Take 20 ounces of the grain or legumes in question from the middle of its bag or container (this needs to be an actual weighed twenty ounces and not estimated). Spread the grain in a large baking dish making sure it is not more than an inch deep. Heat at 180 F for about two hours, stirring occasionally. Allow the grain to cool where it won't readorb moisture, the oven will do. Once cool, reweigh the grain. A one ounce loss in weight indicates the grain had roughly a five percent moisture content, 2 ounces indicates that it has a 10% moisture content, etc, etc. You might even be able to cut it as fine as a half oz loss, but I wouldn't try to take it further than that.

Obviously, this is only a rough measure, but it works and I don't have a better idea that could be used by an individual in the home. If anyone has a better way of measuring moisture levels which can be done without a lab or special equipment I'd surely like to hear it.

#### A.3.2 CLEANING IT YOURSELF

If you've chosen to purchase field-run grain or if the pre-cleaned product you've bought isn't clean enough to suit you, you can do it yourself.

The fastest and easiest method is "fanning", a form of winnowing. This is done by pouring the grain slowly through the air stream of a fan or blower into a clean, deep container such as a cardboard box or trash can. The wind blowing through the falling grain will blow out most of the broken kernels, chaff, smut balls, mouse droppings, etc. If you're losing too much good grain, try turning the fan down or moving it further back from the container. The deep container will cut down on the amount of kernels that bounce out. Repeat fanning as necessary until the grain is clean enough to suit or you've blown all of the lighter contaminants out.

If the fanning didn't get the grain clean enough then it can be further cleaned by running it through a screen or sieve. This should be made with holes just big enough to pass an average sized grain of what it is you're cleaning. Obviously, the size of the holes will necessarily vary depending upon the kernel size of the grain.

Should the kernels still not be clean enough to suit then you'll just have to resort to "hand picking" out the offending particles. I'd strongly suggest doing this just prior to grinding where it can be done in small batches rather than trying to do your entire storage all at once. It's much easier to do a few pounds at a time than fifty or a hundred.

If you have it in mind to wash the grain, this should not be done prior to storage, but, rather, just before use. After it's been rinsed, it should be dried immediately in the oven by placing it no deeper than 1/2 inch and heated at 150 F for an hour. It should be stirred occasionally to improve drying.

#### A.4 STORING GRAINS AND LEGUMES

Having properly prepared your grains and legumes for storage, you're now ready to package it.

For methods and procedures of packaging please see section IV.

#### IV. Specific Equipment Questions

- A. Storage Containers
- B. CO<sub>2</sub> and Nitrogen
- C. Oxygen Absorbers
- D. Desiccants
- E. Diatomaceous Earth

#### B. DRY MILKS

##### B.1 TYPES OF DRY MILKS

NONFAT: This is pasteurized skim milk reduced to a powdered concentrate. It can be found in two forms, regular and instant. They are both made from milk in a spray-drying process, but the instant variety has been given further processing to make it more easily soluble in water than regular dry milk. Both types have the same

nutrient composition. The regular variety is more compact and requires less storage space than the instantized variety, but it is more difficult to reconstitute. The most easily found variety is the instant, available in nearly any grocery store. The regular variety has to be sought out from baking and restaurant suppliers and storage food dealers.

It takes about 3 tablespoons of instant nonfat dry milk added to 8 ozs of water to make 1 cup of milk you can drink or cook with just like fresh milk, albeit with a considerable flavor difference. Combine the dry milk with water at least several hours before you plan to use it to give it time to dissolve fully and to develop a fresher flavor. Shaking the fluid milk vigorously will incorporate air and will also help to improve flavor. I don't care for the stuff to drink, but instead add the powder to baked goods, gravies, smoothies, hot cereals, casseroles and meat loaf as a nutrition booster. It can also be used to make yogurt, cheese and most any cultured dairy product that does not require a high fat content.

**FLAVORED NONFAT:** This may be found packaged in a variety of forms from a low calorie diet drink (artificially sweetened) to the other end of the scale, as cocoa mix or malted milk. The key ingredient is the dry milk so buy and store these products accordingly.

**WHOLE MILK:** This dry milk has a higher fat content and therefore a shorter shelf life than nonfat. Other than that, it can be used in exactly the same way. Dry whole milk is difficult to find, but can sometimes be found where camping and outback supplies are sold.

**BUTTERMILK:** Dry buttermilk is for use in recipes calling for buttermilk. Since it has a slightly higher fat content than nonfat dry milk, it generally does not keep as long.

#### B.1.1 BUYING DRY MILK PRODUCTS

(a)- Be sure the dry milk you are buying has been fortified with vitamins A and D. All of the nonfat dry milks I've seen come fortified with these two vitamins. The dry buttermilk does not come this way, at least the SACO brand does not. I don't know if the flavored mixes and the dry whole milk do or not.

(b)- There should be no artificial colors or flavors. I believe it is illegal to add preservatives to any dry milk sold in the U.S. so a claim of "no preservatives" on the label is of no consequence. Other nations may be different, however.

(c)- "Extra Grade" on the label indicates the manufacturer has held to higher processing and quality standards and the milk is somewhat lower in fat, moisture and bacterial content, is more soluble, and has fewer scorched particles.

There are still some manufacturers of dry milk that sell ordinary Grade A product, but they are becoming fewer. Every brand of instant powdered milk in my local grocery store is the "Extra Grade", even the

generic store brand. This, too, may vary outside of the States.

(d)- Try to buy your dried milk in containers of a size that makes sense for the level of consumption in the household. Once it is opened, powdered milk has a short shelf life before undesirable changes in flavor and nutrient content occurs. If you buy large packages and do not use much at one time, consider breaking it down and repackaging into smaller containers at the time of purchase.

(e)- As with any storage food you buy, try to deal only with reputable dealers. It is particularly important to do this with dry milk because of its short shelf life and sensitivity to storage conditions. Check expiration dates, then date and rotate packages.

## B.2 STORING OF DRY MILKS

Dry milk products are especially sensitive to storage conditions, particularly temperature and light. Vitamins A and D are photo sensitive and will break down rapidly if exposed to light.

The area where your dry milk is stored should be kept as cool as possible. If it is possible to do so, air-conditioning or even refrigeration can greatly extend the nutrient shelf life.

If the storage container is transparent or translucent then it should be put into a second container opaque to light or stored in a dark room.

Dry milk will absorb moisture and odors from the air so storage containers should be impervious to both air and moisture. The drier it can be kept, the better it will keep. Oxygen also speeds decomposition. Powdered milk canned with nitrogen or carbon dioxide to replace air (which contains oxygen) will keep longer than powdered milk exposed to air. Vacuum canning also decreases the available oxygen.

If the dry milk purchased was not packaged for long term storage then it should be repackaged right away.

I purchase the instant variety at my local grocery and repack it when I get it home. I've seen a number of methods used for this and any of them should work.

The method I now use is to pour the powder into clean, dry half-gallon canning jars. Once the jars are filled I add a small desiccant pack and seal. They are dated and stored in the ubiquitous cool, dark place. They must be guarded against breakage, but they offer the advantage of not holding odors, thus allowing for reuse after suitable cleaning. Since they are as transparent the contents must be protected against light. Vacuum sealing and then storing in a dark place may be the best method. Larger jars of 1 gallon size could be used and then re-vacuum sealed after each use. An O<sub>2</sub> absorber would take care of any remaining oxygen and would, itself, last longer when used in conjunction with the vacuum sealer. Being glass, the jar can be reused as well as the lid and ring if they're properly cleaned.

Clean, sound plastic one and two liter soda bottles can also be

used, but probably should be used just once since the plastic is somewhat permeable and will hold odors.

If you have access to a can sealer, #10 cans make wonderful storage containers for dry milk, particularly if used in conjunction with O2 absorbers.

Another method I've seen used is to remove the paper envelopes of milk powder from the cardboard box they come from the grocery store in and to put them in dated plastic bags. These bags are not sealed. The unsealed bags are then placed in a larger, air tight, opaque container. I've heard of plastic buckets, fifty cal and 20 mm ammo cans being used for this purpose. A healthy quantity of desiccant was also placed in the container. This would be another area where O2 absorption packets should serve well. It's important to remember the containers should be clean and odor-free.

Please see section IV Specific Equipment Questions for information concerning the proper use of desiccants, compressed gasses, dry ice and oxygen absorbers.

#### B.2.1 SHELF LIFE OF DRY MILKS

From: SacoFoods@aol.com (Amy Thompson)  
To: Dunross@dkeep.com (Alan Hagan)  
Subj: SACO Mix'n Drink Instant Pure Skim Milk  
Date: May 9, 1996

Dear Mr. Hagan:

Thank you for your e-mail today and for your interest in SACO Mix'n Drink Pure Skim Milk.

Our Mix'n Drink will keep its nutrition value for up to about two years if kept cool and dry, and the only vitamins that actually decrease over time are the vitamins A and D. These are not shelf-stable vitamins and are sensitive to heat and light. A good rule of thumb to follow is that the vitamins A and D will dissipate at a rate of about 20% every year if stored properly. The less heat and moisture the milk is exposed to, the better the vitamins will keep. A freezer could extend the shelf life, as long as the powder does not get moisture in it. If you had to put a time limit on the Mix'n Drink, for rotation purposes, I would date it at two years after the date of purchase.

After opening a package of dry milk, transfer the powder to a tightly covered glass or metal container (dry milk can pick up odors from plastic containers) and keep it in the refrigerator. Unsealed nonfat dry milk keeps for a few months; dry whole milk for a few weeks.

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From: SacoFoods@aol.com (Amy Thompson)  
To: Dunross@dkeep.com (Alan Hagan)  
Subj: SACO Mix'n Drink Instant Pure Skim Milk  
Date: May 21, 1996

Dear Mr. Hagan:

Since vitamins A and D are heat and light sensitive, I would say that your 1 1/2 year shelf life is very reasonable. If you are trying to determine when the nutritional value has been affected more than 40%, as you previously indicated, you should be pretty safe with that time element, as long as it is not exposed to extreme heat.

[Eds note: We were discussing the higher average temperatures found in Florida and other hot climates and the effect that it would have on their dry milk's nutrient content]

#### C. CANNED GOODS

##### C.1 CANNED MILK TYPES

Preserved liquid milk comes in a number of forms, none of which are very similar to each other. The most common forms of these packaged milk are as follows:

CANNED MILKS. These are commonly called UHT milks (Ultra High Temperature) for the packaging technique used to put them up. They come in the same varieties as fresh liquid milks: whole, 2%, 1% and skim. Just recently I've even found whipping cream in UHT packaging (Grand Chef - Parmalat), though this may be offered only in the commercial/restaurant market. In the U.S. they have vitamin D added. The lesser fat content milks do not keep as long as whole milk and their "use by" dates are correspondingly shorter term. This milk is packaged in aseptic containers, either cans or laminated paper cartons. It has the same composition as fresh milk of the same type, and can be stored at room temperature because of the special pasteurizing process used. The milk has a boiled flavor, but much less than evaporated milk. I buy the whole milk and the dates are usually for as much six months. The milk is still usable past their dates, but the flavor soon begins to go stale and the cream separates. I am told by a friend who lived in Germany not long after this kind of canned milk began to come on the market there that they were dated for a year.

With only a six month shelf life this type of canned milk naturally requires a much faster rotation cycle than other types. The only brand name for this milk I've seen is Parmalat. It's a lot of bother, but to me it's worth it to have whole, fluid milk. Recently, I have discovered that it makes excellent yogurt, with the boiled taste disappearing. We have begun using this method for using up our Parmalat as its dates come up and it is rotated out of storage.

EVAPORATED. This is made from fresh, unpasteurized whole milk. The process removes 60% of the water; the concentrate is heated, homogenized, and in the States vitamin D is added. It is then canned and heated again to sterilize the contents. It may also have other nutrients and chemical stabilizers added. A mixture of one part water and one part evaporated milk will have about the same nutritional value of an equal amount of fresh milk. There is generally no date or "use by" code on evaporated milk.

Health and nutrition food stores often carry canned, evaporated goat's milk, in a similar concentration.

SWEETENED CONDENSED. This milk goes through much less processing than evaporated milk. It starts with pasteurized milk combined with a sugar solution. The water is then extracted until the mixture is less than half its original weight. It is not heated because the high sugar content prevents spoilage. It's very high in calories, too: 8 oz has 980 calories.

Although it is often hard to find, the label has a stamped date code which indicates the date by which it should be consumed. Sweetened, condensed milk may thicken and darken as it ages, but it is still edible.

#### C.1.1 SHELF LIFE OF CANNED MILKS

Unopened cans of evaporated milk can be stored on a cool, dry shelf for up to six months. Canned milk (UHT) should be stored till the stamped date code on the package (3 - 6 months). Check the date on sweetened, condensed milk for maximum storage.

#### C.2 CORROSION PREVENTION OF CANNED GOODS

Some areas have difficulty storing metal canned goods for long periods of time. This is usually caused by very high humidity or exposure to salt in a marine environment. If this is a problem, it is possible to extend the life of metal cans by coating their outsides. I've seen this used on boats here in Florida, especially when loading for a long trip. There are at least four methods that can be used to do this:

PARAFFIN METHOD: Using a double boiler, paraffin is melted and brushed on the clean, unrusty cans. Be certain to get a good coat on all seams, particularly the joints. If the can is small enough, it can be dipped directly into the wax. Care must be taken to not cause the labels to separate from the cans. Do not leave in long enough for the can to get warm.

PASTE WAX METHOD: Combine 2-3 ozs of paste or jelly wax with a quart of mineral spirits. Warm the mixture CAREFULLY in its container by immersing it in a larger container of hot water. DO NOT HEAT OVER AN OPEN FLAME! Stir the wax/spirits thoroughly until it is well mixed and dissolved. Paint the cans with a brush in the same manner as above. Place the cans on a wire rack until dry.

SPRAY SILICONE: A light coating of ordinary spray silicone may be used to deter rust. Spray lightly, allow to dry, wipe gently with a clean cloth to remove excess silicone.

CLEAR COATING: A clear type of spray or brush on coating such as Rustoleum (tm) may be applied. This is best suited for larger resealable cans, but will keep them protected from corrosion for years.

## D. SUGAR, HONEY AND OTHER SWEETENERS

There are a wide number of sugars to be found for purposes of sweetening foods. Fructose is the primary sugar in fruit and honey; maltose is one of the sugars in malted grains; pimentose are found in olives and sucrose is what we know as granulated or table sugar. Sucrose is a highly refined product made mostly from sugar cane though sugar beets still contribute a fair amount of the world supply as well. Modern table sugar is now so highly refined as to be virtually 100% pure and nearly indestructible if protected from moisture. Powdered sugar and brown sugar are simple variations on granulated sugar and share its long life.

Liquid sweeteners do not have quite the longevity of dry sugars. Honey, cane syrup, molasses, corn syrup and maple syrup may crystallize or mold during long storage. These syrups are chemically not as simple as table sugar and therefore lose flavor and otherwise break down over a long period of time.

### D.1 TYPES OF GRANULATED SUGARS

Buying granulated sugar and its close cousins is really a very simple matter. Buy a brand you know you can trust and be certain the package is clean, dry and has no insect infestation. There's very little that can go wrong with it.

**GRANULATED.** Granulated sugar does not spoil, but if it gets damp it will likely cake up or get lumpy. If it does, it can simply be pulverized again until it regains its granulated texture. Granulated sugar can be found in varying textures, coarser or finer. Castor/caster sugar is a finer granulation than what is commonly sold as table sugar in the U.S. and is more closely equivalent to our superfine or berry sugar.

**POWDERED CONFECTIONERS ICING** All names refer to the same kind of sugar, that is white granulated sugar very finely ground. For commercial use there is a range of textures from coarse to ultra-fine. For home consumption, what is generally found is either Very Fine (6X) or Ultra-Fine (10X), but this can vary from nation to nation. Not all manufacturers will indicate the grind on the package though. Sugar refiners usually add a small amount of corn starch to prevent caking.

Powdered sugar is as inert as granulated sugar, but it is even more hygroscopic and will absorb any moisture present. If it absorbs more than a little it may cake up and get hard. It's difficult to reclaim hardened powdered sugar, but it can still be used like granulated sugar.

**BROWN, LIGHT/DARK.** In the United States brown sugar is basically just refined white sugar that has had a bit of molasses or sugar syrup and caramel coloring added to it. Dark brown sugar has more molasses which gives it a stronger flavor, a darker color and makes it damp. Light brown sugar has less molasses which gives it a milder flavor, a blonder color and is slightly dryer than the dark variety. For storage purposes you may want to just stock the dark variety. Light

brown sugar can be made by combining one fourth to one third white sugar to the remainder dark brown sugar and blend thoroughly.

Both varieties need to be protected from drying out, or they will become very hard and difficult to deal with. Nor do you want to allow them to become damper than what they already are.

There are granulated and liquid brown sugars available, but they don't have the same cooking qualities as ordinary brown sugars. They also don't dry out and harden quite so readily either.

RAW            In recent years, sugar refiners have realized that there is a  
NATURAL       market for less refined forms of cane sugar here in the U.S.  
TURBINADO      and have begun to sell this kind of sugar under various names  
                  and packagings. None of it is really "raw" sugar since it is  
illegal to sell it in the U.S. due to the high impurities level in truly  
raw sugar. All of it has been processed in some form or fashion to clean  
it, but it has not been subjected to the full refining and whitening  
processes of ordinary white table sugar. This leaves some of the  
natural color and a mild flavor in the sweetener. All of these less  
refined sugars should be stored and handled like brown sugar.

Outside of the United States it is possible to buy truly raw sugar and it can be found under names such as "muscavado", "jaggery" (usually a raw palm or date sugar), "demerara" and others. With all of the molasses and other impurities retained it is quite strong in flavor so would not be suited to general use, but there are recipes that call for it. In spite of moisture and impurities it can be stored like brown sugar since its sugar content is high enough to inhibit most microbial growth.

#### D.1.1 STORING GRANULATED SUGARS

All granulated sugars have basically the same storage requirements. They need to be kept in air tight, insect and moisture proof containers. For powdered, granulated and (U.S.) raw sugar you might want to consider using some desiccant in the storage container if your local climate is damp. Since brown sugars and raw sugars (non-U.S.) are supposed to be moist, they do not need desiccants. Shelf life is indefinite if kept dry, but anything that you intend to eat really should be rotated over time. Time has a way of affecting even the most durable of foods.

I've used brown sugar that was six years old at the time it was removed from storage and other than the molasses settling somewhat towards the bottom it was just fine. A friend who I gave a bucket of the brown sugar to just finished it off three years after I gave it to her and it, too, was fine.

#### D.2 TYPES OF HONEY

Honey is probably the oldest sweetener known to man. It predates recorded history and has been found in the Egyptian pyramids. It's typically sweeter than granulated sugar by a factor of 25%-40% depending upon the specific flowers from which the bees gather their nectar. This means a smaller amount of honey can give the same amount of sweetening

as sugar. The source flowers also dictate the flavor and the color of the sweetener as well. Honey color can range from very dark (nearly black) to almost colorless. As a general rule, the lighter the color and the more delicate the flavor, the greater the price the honey will bring. As you might expect, since honey is sweeter than table sugar, it also has more calories as well -- 22 per teaspoon compared to granulated sugar's 16 per teaspoon. There are also trivial amounts of minerals and vitamins in the bee product while white sugar has none. Raw honey may also contain minute quantities of botulinum spores and should not be fed to children under one year of age. PLEASE READ THE POST FROM GERI GUIDETTI CONCERNING THIS BELOW. Raw honey is OK for older children and adults. Honey is not a direct substitute for table sugar however, it's use in recipes may call for a bit of alteration to get the recipe to turn out right.

Honey comes in a number of forms in the retail market and they all have different storage characteristics:

**WHOLE-COMB:** This is the bee product straight from the hive. This is the most unprocessed form in which honey comes, being found as large pieces of waxy comb floating in raw honey. The comb itself will contain many unopened honey cells.

**RAW:** This is unheated honey that has been removed from the comb. It may contain bits of wax, insect parts and other small detritus.

**FILTERED:** This is raw honey that has been warmed slightly to make it more easy to filter out small particles and impurities. Other than being somewhat cleaner than raw honey it is essentially the same. Most of the trace amounts of nutrients remain intact.

**LIQUID:** This is honey that has been heated to higher temperatures to allow for easier filtering and to kill any microorganisms. Usually lighter in color, this form is milder in flavor, resists crystallization and generally clearer. It stores the best of the various forms of honey. Much of the trace amounts of vitamins, however, are lost.

**SPUN OR CRYSTALIZED** This honey has had some of its moisture content removed to make a creamy, spread. It is the most processed form of honey.

#### D.2.1 BUYING HONEY

Much of the honey sold in supermarkets has been blended from a variety of different honeys and some may have even had other sweeteners added as well. Like anything involving humans, buying honey can be a tricky business. It pays to deal with individuals and brands you know you can trust. In the United States you should buy labeled U.S. GRADE A or U.S. FANCY if buying in retail outlets. However, be aware there are no federal labeling laws governing the sale of honey, so only honey labeled "pure" is entirely honey and not blended with other sweeteners. Honey grading is a matter of voluntary compliance which means some producers may be lax and sloppy about it. This can be a real nuisance when producers use words like "organic", "raw", "uncooked" and "unfiltered" on their labels, possibly to mislead. Fortunately, most

honey producers are quite honest in their product labeling so if you're not certain of who to deal with, it is worthwhile to ask around to find out who produces a good product.

Honey may also contain trace amounts of drugs used in treating various bee ailments, including antibiotics. If this is a concern to you, then it would be wise to investigate with your local honey producer what has been used.

#### D.2.2 STORING HONEY

Honey is much easier to store than to select and buy. Pure honey won't mold, but may crystallize over time. Exposure to air and moisture can cause color to darken and flavor to intensify and may speed crystallization as well. Comb honey doesn't store as well liquid honey so you should not expect it to last as long.

Storage temperature is not as important for honey, but it should be kept from freezing and not exposed to high temperatures if possible. Either extreme can cause crystallization and heat may cause flavor to strengthen undesirably.

Filtered liquid honey will last the longest in storage. Storage containers should be opaque, airtight, moisture- and odor-proof. Like any other stored food, honey should be rotated through the storage cycle and replaced with fresh product.

If crystallization does occur, honey can be reliquified by placing the container in a larger container of hot water until it has melted.

Avoid storing honey near heat sources and if using plastic pails don't keep it near petroleum products (including gasoline engines), chemicals or any other odor-producing products.

#### D.2.3 RAW HONEY AND BOTULISM

From: Geri Guidetti <arkinst@concentric.net>

Duane Miles wrote:

>If I recall correctly, honey contains very, very small amounts of the  
>bacteria that cause botulism. For adults, this seldom causes problems.  
>Our immune system is capable of dealing with small numbers of even  
>nasty bacteria, they do it all the time. The problem is when we get  
>large numbers of bacteria, or when our immune system is damaged or not  
>yet developed.  
>  
>That is where the problem with honey comes in. Some people used to use  
>honey to sweeten milk or other foods for infants. Infants immune  
>systems sometimes cannot handle the bacteria that cause botulism, and,  
>of course, those infants became seriously ill. So pediatricians now  
>advise strongly against using honey for children under a certain age.

Yes, honey can contain the temperature resistant spores of *Clostridium botulinum*, the bacterium that causes botulism. The organism is a strict anaerobe, meaning that it only grows in the absence of molecular oxygen.

The problem with infants and honey is that the small, intestinal tract of an infant apparently is sufficiently anaerobic to allow the spores to germinate into actively growing C. botulinum organisms. Essentially, the infant serves the same role as a sealed, airtight, contaminated can of beans as far as the organisms are concerned. There in the infant's body the bacteria secrete the dangerous toxin that causes the symptoms of botulism. There have been quite a few documented infant deaths due to honey. As I recall, the studies identifying honey as the source were done in the '80s. Most pediatricians recommend no honey for the first year. It is probably best to check with your own for even later updates...Geri Guidetti, The Ark Institute

#### D.2.4 HONEY OUTGASSING

Q: My can of honey is bulging. Is it safe to use?

A: Honey can react with the can lining to release a gas especially when stored over a long period of time. Honey's high sugar content prevents bacteria growth. If there is no sign of mold growth, it is safe to eat. FREQUENTLY ASKED FOOD QUESTIONS, FN250

#### D.3 TYPES OF CANE SYRUPS.

MOLASSES and These two sweetners are not precisely the same thing.

CANE SYRUP: Molasses is a by-product of sugar refining and cane syrup is simply cane juice boiled down to a syrup, in much the same way as maple syrup is produced. Non-Southerners (U.S.) may know it better as "unsulphured molasses" even if this is not completely correct. Sulphured molasses is available on the market and very cheap as well, but it's strong flavor is unattractive and generally not desireable.

SORGHUM SYRUP: This is produced in the same manner as cane syrup, but sorghum cane, rather than sugar cane, is used. Sorghum tends to have a thinner, slightly sourer taste than cane syrup.

TREACLE: This sweetner comes in varying colors from a rather dark version, similar to, but not quite the same as blackstrap molasses, to paler versions more similar to golden syrup.

All these syrups are generally dark with a rich, heavy flavor.

GOLDEN SYRUP: This syrup seems to be both lighter and paler in color than any of the above three, probably more similar to what we would call a table syrup here in the U.S.

TABLE SYRUP: There are many "table syrups" sold in supermarkets, some with flavorings of one sort or another such as maple, various fruits, etc. A close examination of the ingredients list will reveal mixtures of cane syrup, cane sugar syrup or corn syrup along with preservatives, colorings and other additives. They usually have a much less pronounced flavor than molasses, cane syrup, sorghum or the darker treacles. Any syrup containing corn syrup should be stored as corn syrup.

#### D.3.1 STORING CANE SYRUPS

All of the above syrups, except for those having corn syrup in their makeup, have the same storage characteristics. They can be stored on the shelf for about two years and up to a year after opening. Once they are opened, they are best kept in the refrigerator to retard mold growth. If mold growth does occur, the syrup should be discarded. The outside of the bottle should be cleaned of drips after each use. Some pure cane and sorghum syrups may crystallize in storage, but this causes no harm and they can be reliquified using the same method as for honey.

#### D.4 CORN SYRUP

Corn syrup is a liquid sweetener made by an enzyme reaction with corn starch. Available in both a light and a dark form, the darker variety has a flavor similar to molasses and contains refiners syrup (a byproduct of sugar refining). Both types often contain flavorings and preservatives. They are commonly used in baking and candy making because they do not crystallize when heated. Corn syrup is very common in the U.S., but less so in the rest of the world.

Corn syrup stores poorly compared to the other common sweeteners and because of this it often has a "best if used by" dating code on the bottle. It should be stored in its original bottle, tightly capped, in a cool, dry place. New unopened bottles keep about six months from the date on the label. After opening, keep the corn syrup four to six months. These syrups are very prone to mold and to fermentation so be on the lookout for bubbling or a mold haze. If these present themselves, throw the syrup out. You should always be certain to wipe off any drips from the bottle after every use.

I don't recommend corn syrup as a storage food since it stores so poorly.

#### D.5 MAPLE SYRUP

Maple syrup is probably the only sweetener that has developed a cult-like following (OK, cane syrup has its ardent fans too). Produced by boiling down maple sap until it reaches a syrup consistency, it is slightly sweeter than table sugar. Maple syrup is judged by much the same criteria as honey: Lightness of color, clarity and taste. Pure maple is generally expensive and most pancake syrups are corn and cane sugar syrups with either natural or artificial flavorings.

New unopened bottles of maple syrup may be kept on a cool, dark, shelf for up to two years. The sweetener may darken and the flavor get stronger, but it is still usable.

After the bottle has been opened, it should be refrigerated. It will last about a year. Be careful to look out for mold growth. If mold occurs, discard the syrup.

Flavored pancake syrups should be kept and stored as corn syrups.

## E. FATS AND OILS

All oils are fats, but not all fats are oils. They are very similar to each other in their chemical makeup, but what makes one an oil and another a fat is the percentage of hydrogen saturation in the fatty acids of which they are composed. The fats and oils which are available to us for culinary purposes are actually mixtures of differing fatty acids so for practical purposes we'll say saturated fats are solid at room temperature (70 F) and unsaturated fats we call oils are liquid at room temperature. For dietary and nutrition purposes fats are generally classified as saturated, monosaturated and polyunsaturated, but this is just a further refinement of the amount of saturation of the particular compositions of fatty acids in the fats.

### E.1 BUYING AND STORING OILS AND FATS

There is a problem with storing oils and fats for the long term and that is the fact that they go rancid rather quickly. Rancid fats have been implicated in increased rates of heart disease, atherosclerosis and are carcinogenic (cancer causing) so we want to avoid them if possible.

Oxygen is eight times more soluble in fats than in water and it is the oxidation resulting from this exposure that is the primary cause of rancidity. The more polyunsaturated a fat is, the faster it will go rancid. This may not, at first, be readily apparent because vegetable oils have to become several times more rancid than animal fats before our noses can detect it. An extreme example of rancidity is the linseed oil (flaxseed) that we use as a wood finish and a base for oil paints. In just a matter of hours the oil oxidizes into a solid polymer. This is very desirable for wood and paint, very undesirable for food.

Because of this difficulty in storing fats and oils for any long period of time many books and articles on the subject of food storage make only passing mention of them, if they say anything at all. This is unfortunate because fat contains nine calories per gram compared to the four calories contained by either carbohydrates or protein. This makes fat a valuable source of concentrated calories that could be of real importance if faced with a diet consisting largely of unrefined grains and legumes. For small children, infants and the elderly, they may not be able to consume the volume of food that would be necessary in the course of a day to get all of the calories they would need to avoid weight loss and possible malnutrition. Additionally, fats play an important role in our perception of taste and texture and their absence would make many foods more difficult to prepare and consume. Furthermore, a small amount of dietary fat is necessary for our bodies to properly absorb fat soluble vitamins like A,D,E and K.

Long term storage of fats may be problematical, but it is not impossible. There are some general rules you can follow to get the most life out of your stored cooking oils and fats.

#1-- Exposure to oxygen, light and heat are the greatest factors to rancidity. If you can, refrigerate your stored oil, particularly after it's been opened. If possible, buy your oils in opaque, airtight containers. If you purchase it in plastic, particularly clear plastic, then transfer it to a gas impermeable glass or metal container that can

be sealed airtight. If you have a means of doing so, vacuum sealing the storage container is an excellent idea as it removes most of the air remaining inside, taking much of the oxygen with it. Transparent glass and plastic containers should be stored in the dark, such as in a box. Regardless of the storage container, it should be stored at as cool a temperature as possible and rotated as fast as is practical. Oils and fats with preservatives added by the manufacturer will have a greater shelf life than those without them, provided they are fresh when purchased.

#2-- Unless they have been specially treated, \*unopened\* cooking oils have a shelf life of about a year, depending upon the above conditions. Some specialty oils such as sesame and flax seed have even shorter usable lives. If you don't use a great deal of it, try not to buy your fats in large containers. This way you won't be exposing a large quantity to the air after the you've opened it, to grow old and possibly rancid, before you can use it all up. Once opened, it is an excellent idea to refrigerate cooking fats. If it turns cloudy or solid, the fat is still perfectly usable and will return to its normal liquid, clear state after it has warmed to room temperature. Left at room temperatures, opened bottles of cooking oils can begin to rancid in anywhere from a week to a couple of months, though it may take several more months to reach such a point of rancidity that it can be smelled.

#3-- Although darker colored oils have more flavor than paler colored, the agents that contribute to that flavor and color also contribute to faster rancidity. For maximum shelf life buy paler colored oils.

#4-- If you have no particular problem with using it, the culinary fat with the most shelf life as it comes from the store is hydrogenated shortening in its unopened metal or metal lined can. The brand most familiar in the U.S. is probably Crisco (tm), but there are many others. Solid shortening is usually composed of partially hydrogenated vegetable oils, but there are some that also contain animal fats. Some brands will also contain anti-oxidant preservatives as well. All other conditions being equal, those with preservatives will have a longer shelf life than those without. It is not possible to give an exact answer, but it is reasonable to expect an unopened metal can of shortening to have a shelf life of eight to ten years if kept reasonably cool, particularly if it has preservatives in it.

Outside of the U.S., hydrogenated vegetable shortening may be tricky to find. A product that \*may\* be similar is copha, a solid, mostly saturated coconut fat. If packaged in a similar manner as the vegetable shortening above it might keep for a similar length of time, providing the manufacturer used good technique and fresh raw material. Again, any preservatives added to it will extend the shelf life. I have no experience with copha and am going on what I have read of the product. If anyone can send me factual information I'll gladly use it.

## E.2 EXTENDING SHELF LIFE BY ADDING ANTI-OXIDANTS

If obtaining the maximum shelf life in your cooking oils is important to you, it is possible to add anti-oxidant preservatives to the fat after you have purchased it. If used in conjunction with a gas

impermeable container, either opaque in color or stored in a dark place, and cool storage temperatures (70 F or less) then shelf life can be extended to about five years, possibly longer.

The anti-oxidant in question is Butylated HydroxyToluene (BHT). It is used in the food industry to slow the development of off-flavors, odors and color changes caused by oxidation, mostly in foods that are high in fats and oils. BHT is on the U.S. Food and Drug Administration's Generally Recognized As Safe (GRAS) list as a common preservative. The FDA limits the use of BHT to 0.02% or 200 parts per million (ppm) of the oil or fat content of a food product. The directions that I will be giving below will be for the FDA limit, but there are those who choose to use up to ten times that amount as part of their life extension programs. The level you choose is up to you.

BHT is available over the counter in the retail trade, but you have to know where to look for it. The only retail distributor of the anti-oxidant that I am thus far aware of is Twin Laboratories (TwinLab), Ronkonkoma, NY 11779. Their BHT comes in the form of 250 mg gelatin capsules. I've been able to find their product in several local health food stores. It is also available through mail order sources, but I don't have any names or addresses for that avenue yet.

To get the best results you will need the freshest oil you can find. Purchasing it from a large, busy supermarket will probably suffice. You'll also need containers that are gas impermeable such as glass jars, or metal cans. There may be plastic containers made of thick High Density PolyEthylene (HDPE) that will also serve, but I cannot knowledgably say about this. Make sure your containers are clean, dry and dust-free.

Each 250 milligram capsule is sufficient to treat 47 fluid ounces of cooking oil (as per the GRAS guidelines mentioned above). If you have an accurate means of weighing this works out to be 5.3 mg of BHT crystals to every 1 fl oz of oil. If you're using a scale calibrated in grains, such as a reloading powder scale, you may use the following table.

BHT in grains	OIL	BHT in milligrams
0.1 grain	1 fl oz	5.3 mg
0.7 grain	8 fl oz (1 cup)	42.4 mg
1.3 grain	16 fl oz (1 pint)	84.8 mg
2.6 grain	32 fl oz (1 quart)	169.6 mg
5.2 grain	64 fl oz (1/2 gal)	339.2 mg
10.3 grain	128 fl oz (1 gal)	678.4 mg

NOTE: The grain weight measurements have been rounded up to the nearest tenth grain since most powder scales will not accurately measure less than one tenth of a grain.

IMPORTANT NOTE: If you are using a reloading powder scale, be sure the pan is \*clean\* and the balance has been calibrated recently with a reliable set of check weights.

Remove the BHT crystals from their gelatin capsules and weigh, if

you're going to. Once you have the appropriate amount, add the crystals to a pint or so of the oil, shaking vigorously. It may take several hours for the preservative to dissolve completely. Bringing the oil up to a warm, NOT hot, temperature will speed the process. Once completely dissolved, pour the anti-oxidant laden oil into the rest of the oil and mix thoroughly. Once mixed, the oil can then be poured into its storage containers leaving approximately 1/2 inch of headspace. If you have a vacuum sealer the jars or cans may be vacuum sealed to remove most of the oxygen from the container, otherwise just seal the lid. Store in a cool place and if using transparent jars, be certain to put them in a larger container such as a box to keep the contents in the dark. Don't forget to label and date the jars.

There are other preservatives in food industry use that will also work, but I have not yet discovered how they are used or where to get them. I'm currently looking for information on Butylated HydroxyAnisole (BHA), propyl gallate, vitamin E (the tocopherols, natural and synthetic), ascorbyl palmitate (a fat soluble form of vitamin C), citric acid and mono-Tertiary-ButylHydroQuinone (TBHQ). Additionally, certain herbs and spices like cloves, rosemary, oregano, sage and vanilla also have antioxidant properties, sometimes quite strong ones. Being strongly flavored, they are not suitable as preservatives in fats meant for general use, but will lend their protective properties in any recipes that calls for them.

Before I close out this section on fats and oils, please allow me to reemphasize that no amount of preservatives that can be added to your stored fats will substitute for proper storage and rotation. The more I research the chemistry and physiological effects of rancid fats the more I come to believe they are bad news for long term health, particularly as we grow older. Don't sit on your oil supply for years without rotating it. Just a little bit rancid is just a little bit poisonous.  
`Nuff said.

## Y. COOKING STAPLES

### Y.1 BAKING POWDER.

This powder is a combination of an acid, an alkali, and a starch to keep the other ingredients stable and dry. The powder reacts with liquid by foaming and the resulting bubbles can aerate and raise dough. Almost all baking powder now on the market is double acting, meaning it has one acid that bubbles at room temperature and another acid which only reacts at oven temperatures. Unless a recipe specifies otherwise, this is the type to use.

Don't expose baking powder to steam, humid air, wet spoons, or any other moisture. Store in a tightly lidded container for no more than a year. Even bone dry baking powder eventually loses its potency. To test its strength, measure 1 tsp powder into 1/3 cup hot water. The mixture should fizz and bubble furiously. If it doesn't, throw the baking powder out.

For those folks concerned with aluminum in the diet, the Rumford brand has none in it and there may be others.

#### Y.2 BAKING SODA.

This gritty powder is sodium bicarbonate also called sodium acid bicarbonate ( $\text{NaHCO}_3$ ), a mild alkali. It is used in baking to leaven bread and does so in the same manner as baking powder. When combined with an acid ingredient, the bicarbonate reacts to give off carbon dioxide bubbles which causes the baked good to rise. If kept well sealed in an air- and moisture-proof container its storage life is indefinite. If kept in the cardboard box it usually comes in, it will keep for about eighteen months. Do keep in mind that baking soda is a wonderful odor absorber. If you don't want your baked goods tasting of whatever smells it absorbed then keeping it in an airtight container is an excellent idea.

#### Y.3 HERBS AND SPICES.

It is difficult to give exact instructions on how best to store culinary herbs and spices because there are dozens of different seeds, leaves, roots, barks, etc., we call an herb or a spice. There are, however, some general rules to be followed to best preserve their flavors. All spices, particularly dried, are especially sensitive to heat, air and light. Room temperature is fine for keeping them and refrigeration or freezing is even better, but they should be kept away from heat sources. It is common for the household spice cabinet or shelf to be located over the stove, but this is really a very poor place. Dark opaque glass is best for storage, but failing that, keeping a tightly sealed glass container in a dark place is next best. The cellophane packets some products come in just won't do for storage. Tightly sealed metal containers will work as well. Even dense plastic will do, but glass is best.

Where possible, buy spices whole. Whole nutmegs will keep their flavor far longer than ground nutmeg, the same for other seeds and roots. You'll have to use a grater, grinder or whatever, but the difference in flavor will be worth it.

If you buy spices in bulk containers (which is certainly cheaper) consider transferring some into smaller containers and keeping the larger one tightly sealed in a cool, dark place. This will prevent unwanted light and air from continually getting in and playing havoc.

Included in the suppliers addresses are listings for several spice and herb companies. The one I have personally dealt with so far is Penzey's and their products have been consistently good. It's worth investigating some of these companies as they can really take the sting out of purchasing large quantities.

#### Y.4 SALT.

Storage life for salt is indefinite. So long as you do not let it get contaminated with dirt or whatever, it will never go bad. Over time, iodized salt may turn yellow, but this is harmless and may still be used. Salt is rather hygroscopic and will adsorb moisture from the air if not sealed in an air-tight container. If it does adsorb moisture and cakes up, it can be dried in the oven and then broken up with no harm.

done.

All salt, however, is not the same. Salt comes in a number of different varieties, each with its own purpose. Very little of the salt produced in the U.S. is intended for use in food. The rest of it, about 98%, has other uses. Therefore, it is important to be certain the salt you have is intended for human consumption. Once you are satisfied it is, you should then determine its appropriateness for the tasks to which you might want to set it to. Below is a partial list of some of the available salts. I hope to make it more complete as I find better information.

**TABLE SALT:** This is by far the most widely known type of salt. It comes in two varieties; iodized and non-iodized. There is an ingredient added to it to absorb moisture so it will stay free flowing in damp weather. This non-caking agent does not dissolve in water and can cause cloudiness in whatever solution it is used if sufficiently large quantities are used. In canning it won't cause a problem since there is very little per jar. For pickling, though, it would be noticeable. If you are storing salt for this purpose, you should be sure to choose plain pickling salt, or other food grade pure salt such as kosher salt. In the iodized varieties, the iodine can cause discoloration or darkening of pickled foods so be certain not to use it for that purpose.

**CANNING SALT:** This is pure salt and nothing, but salt. It can usually be found in the canning supplies section of most stores. This is the salt to be preferred for most food preservation or storage uses. It is generally about the same grain size as table salt.

**KOSHER SALT:** This salt is not really, in itself, kosher, but is used in "kashering" meat to make the flesh kosher for eating. This involves first soaking the meat then rubbing it with the salt to draw out the blood which is not-kosher and is subsequently washed off along with the salt. The remaining meat is then kosher. What makes it of interest for food storage and preservation is that it is generally pure salt suitable for canning, pickling and meat curing. It is of a larger grain size than table or canning salt, and usually rolled to make the grains flaked for easier dissolving. Frequently it is slightly cheaper than canning salt and usually easier to find in urban/suburban areas.

**NOTE:** Not all brands of kosher salt are exactly alike. Diamond Crystal Kosher Salt is the only brand that I'm aware of that is not flaked, but still in its unaltered crystal form. The Morton brand of Coarse Kosher Salt has "yellow prussiate of soda" added to it as an anti-caking agent. Morton still recommends it for pickling and even gives a kosher dill recipe on the box so I presume that this particular anti-caking agent does not cause cloudiness in pickling solutions.

Whether flaked or in its unaltered crystal form, kosher salt takes up more volume for an equivalent amount of mass than does canning salt. If it is important to get a very precise amount of salt in your pickling or curing recipe you may want to weigh the salt to get the correct amount.

**SEA SALT:** This type of salt comes in about as many different varieties

as coffee and from about as many different places around the world. The "gourmet" versions can be rather expensive. In general, the types sold in grocery stores, natural food markets and gourmet shops have been purified enough to use in food. It's not suitable for food preservation, though, because the mineral content it contains (other than the sodium chloride) may cause discoloration of the food.

ROCK or ICE CREAM SALT: This type of salt comes in large chunky crystals and is intended primarily for use in home ice cream churns to lower the temperature of the ice filled water in which the churn sits. It's also sometimes used in icing down beer kegs or watermelons. It is used in food preservation by some, but none of the brands I have been able to find label it as food grade nor specifically mention its use \*in\* foods so I would not use it for this purpose.

SOLAR SALT: This is also sometimes confusingly called "sea salt". It is not, however, the same thing as the sea salt found in food stores. Most importantly, it is \*not\* food grade. It's main purpose is for use in water softeners. The reason it is called "solar" and sometimes "sea salt" is that it is produced by evaporation of sea water in large ponds in various arid areas of the world. This salt type is not purified and still contains the desiccated remains of whatever aquatic life might have been trapped in it. Those organic remains might react with the proteins in the foods you are attempting to preserve and cause it to spoil.

HALITE: For those of us fortunate enough to live in areas warm enough not need it, halite is the salt that is used on roads to melt snow and ice. It, too, is not food grade and should not be used in food preservation. This form of salt is also frequently called rock salt, like the rock salt above, but neither are suitable for food use.

SALT SUBSTITUTES: These are various other kinds of metal salts such as potassium chloride used to substitute for the ordinary sodium chloride salt we are familiar with. They have their uses, but should not be used in foods undergoing a heated preservation processing, as they can cause the product to taste bad. Even the heat from normal cooking is sometimes sufficient to cause this.

#### Y.5 VINEGAR.

There is vinegar and then there is vinegar and it is not all alike. The active ingredient in all vinegars is acetic acid, but what the sour stuff is made from can vary widely. The most common vinegar is the white distilled variety which is actually just diluted distilled acetic acid and not true vinegar at all. It keeps pretty much indefinitely if tightly sealed in a plastic or glass bottle with a \*plastic\* cap. The enamel coated metal caps always seem to get eaten by the acid over time. It is usually about 5-6% acetic acid and for pickling it is the type most often called for.

The next most common variety is apple cider vinegar. There are two kinds of this type. A "cider flavored" distilled acetic acid type and a true cider vinegar fermented from hard cider. Either will store indefinitely at room temperature until a sediment begins to appear on

the bottom. Stored vinegar will sometimes develop a cloudy substance. This is called a "mother of vinegar" and it is harmless. As long as the liquid does not begin to smell foul it can be filtered out through cheesecloth or a coffee filter and rebottled in a clean container. The mother can even be used to make more vinegar. If it begins to smell bad, however, it's gone over and should be tossed out.

The more exotic wine vinegars, balsamic and other types all can be stored like cider vinegar. Age and exposure to light and air, however, eventually begin to take their toll on their delicate flavors. Tightly capped in a cool, dark cabinet or refrigerator is best for their storage.

#### Y.6 YEAST.

Yeast is just not a product you can stow away and forget about until you need it next year. It is, after all, a living organism and if it's not alive at the time you need it, you won't get any use out of it. This ancient leavening, brewing, fermenting agent is a single celled microscopic fungus. When we incorporate it into our bread dough, beer wort or fruit juice it begins to reproduce madly (we hope) and produce several by-products. If you're baking, the by-product you want is carbon dioxide which is trapped by the dough and subsequently causes it to rise. In brewing or vintning what is wanted is the ethyl alcohol and, if the drink is to be carbonated, the carbon dioxide.

Almost all yeasts used for these purposes are in the same genus (*Saccharomyces* or "sugar fungi"), but several different species have evolved and some are more suitable for a particular task than others. It's entirely possible to use grocery store bread yeast to brew beer or ferment wine, but the results may leave a great deal to be desired. It's also possible to use yeast from beer brewing to make bread and from what I've read the results were pretty much indistinguishable from bread yeast.

Leaving aside the brewing and vintning yeasts which are really outside the scope of this FAQ I am going to concentrate on bread yeast. It comes in two generally available forms; compressed or fresh and dried, sometimes called granular or instant active dry yeast. They are different genetic strains of the same species, but have different characteristics.

Compressed yeast is only partly dried (about 70% moisture) and requires refrigeration and keeps even better in the deep freeze. If kept in an air- and moisture-tight container to prevent it from desiccating this type of yeast will keep for a year in the freezer (0 degs F or less, but only about two weeks (maybe a bit more) in the refrigerator. Unless your kitchen is rather chilly it will not keep on the shelf. It should not have a mottled color or a sour odor.

Dried yeast has only an 8% moisture content and comes packed in foil envelopes. The smaller single use packets are not generally vacuum packed, but the larger commercial sized "bricks" of about a pound or two each generally are. They can last for months on the shelf, up till the expiration date which should be clearly stamped on the package. If packaged in the same manner as recommended for compressed yeast above and kept in the refrigerator or freezer it can last for several years.

The larger packs of yeast should be transferred to an air and moisture tight container after opening.

Either type of yeast can be tested for viability by "proofing" it. This is nothing more than mixing a small amount of the yeast with an equal amount of sugar in warm water (105-115 deg F for dried; 95 deg F for fresh). Within about five minutes active yeast will become bubbly and begin to expand (at normal room temperature). Yeast which only slowly becomes active can still be used, but you will have to use more of it. If it shows no activity at all, it's dead and should be thrown out.

There is another means of providing yeast for baking besides buying it from the grocery store and that is by using a sourdough starter. I'm not going to address it here, but I will point out that it has a newsgroup all its own (rec.food.sourdough) and several FAQ's devoted to it. Drop in and read for awhile and you'll learn more than you thought you could ever want to know.

## Z. INFANT FORMULA

Since most folks interested in preparedness of one sort or another are planning for families, real or as yet hypothetical, I thought it important to include something on infant formula. Most baby food that comes in jars can be treated like canned goods of types meant for adults. Formula, though, is something else. I have to admit, that not yet having kids of my own, I've not given this much thought before so the below is taken from the book KEEPING FOOD FRESH, by Janet Bailey (see book list). In the future, if some of you readers will send it to me and/or I come up with more information from my own researches I want to expand this section on infant/child food storage.

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Prepared infant formula is primarily water and nonfat cow's milk. Among other ingredients, it contains sweeteners; sometimes lactose which is milk sugar; and sometimes corn syrup or other sugars. Coconut and soybean oils are common; vitamin and mineral supplements are universal. A few brands contain mono- and diglycerides, chemicals that keep the liquid from separating.

BUYING AND STORING INFANT FORMULA. Canned liquid infant formula comes either ready to eat or in a concentrate to be diluted with water. Cans and packing cases are clearly marked with a "use by" date.

Unopened cans stored in a cool, dry place keep well from twelve to eighteen months (longer than the baby is an infant).

After the can is opened, measure out the amount of formula you need, cover the can and store in the refrigerator. It will keep no more than 48 hrs at 40 deg F. Never return leftover formula from the bottle to the storage container and do not store half used bottles.

You can pre-measure the whole can-full into sterilized baby bottles, seal them, and store them in the refrigerator, but forty eight hours is still the limit. To keep full bottles from tipping over in the refrigerator, slip them into a carton from a six-pack of soda pop

bottles.

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In examining the offerings at my local grocer I see that infant formula is also offered as a dry powder to be mixed by the parent. I could not come to a ready idea of how long the formula powder might be good on the shelf since it seemed to vary radically depending on exact type and manufacturer. The shortest use-by date was only a year, but some had use-by dates three years into the future. Clearly, this is an area that is going to need much investigation. I hope some of our knowledgeable readers out there will be able to help out.

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### III -- SPOILAGE

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#### A -- INSECT INFESTATIONS

##### A.1 PESTS OF STORED GRAINS, LEGUMES AND DRY FOODSTUFFS

Insect infestations can occur in a wide variety of foodstuffs such as flours, meals, pastas, dried fruits and vegetables, nuts, sweets, whole grains, beans, sugars, TVP, jerky, bird seed and pet foods.

Naturally, the best way to deal with an insect infestation is not to have one in the first place. Try to purchase from suppliers who are clean and have a high volume of turnover of their products. This will mean the products you purchase will be unlikely to have bugs in them.

When you buy such foodstuffs examine them closely to be sure they are insect free. Check for any packaging or "use by" dates to insure their freshness. Don't shake the package, most adult insects will be found in the top couple of inches of the product and shaking the package will mix them into the contents and disguise them. If the package does turn out to be infested, return it for replacement.

Once you have purchased the product you should store it in an air-and moisture-tight container so it cannot be invaded after you have brought it home. With sufficient time, adult and some larval insect forms can penetrate paper, cardboard and thin plastic packaging. Your containers should be either heavy plastic, glass or metal with tight fitting lids. As with everything in food storage, you should use older packages before newer ones and opened packages before unopened ones.

The storage area should be kept clean. Don't allow grain, flour, beans, bits of pasta or other food particles to accumulate on shelves or the floor. Cracks and crevices should be sealed or otherwise blocked. Unless it is a sticky spill, vacuuming is the best method of cleaning since cleaning with soap and water can wash food particles into the cracks.

Insects may get their start in chairs, sofas and carpets where food is dropped and not cleaned up. Don't forget to replace the filter bag on the vacuum since some insects can survive and reproduce in the bag after they've been sucked into it.

Bags of dry pet food and bird seed can also harbor insect infestation. Decorative foodstuffs such as ears of colorful Indian corn, colored beans and hard squashes can carry insects that can infest your edible food. Even poison baits can harbor flour beetles.

#### A.2 CONTROL OF INSECT INFESTATIONS

Should you find that in spite of buying fresh products and using careful packaging techniques you have an insect infestation you can try some of the following steps:

1. If the food is too heavily infested to try to save then it should be disposed of as soon as possible. Don't leave it in the kitchen or food storage area any longer than necessary so it won't infest other foods.

2. Large bugs can be sifted or winnowed out if it's not too heavily infested and you want to try to save it. Then treat it by placing into a deep freezer at 0 F for three to seven days depending upon the size of the package. Refrigerator freezers usually do not freeze low enough to effectively kill all of the life stages of insects, but if left there, will slow their development. If freezing is not workable then the product could be spread on baking sheets and heated to 150 F for fifteen to twenty minutes, cooled and repackaged. Heat treated foods should be consumed shortly thereafter.

3. The surface areas where the food \*containers\* are stored can be treated with an insecticide. This is not a replacement for clean storage habits and good containers, but it can supplement it. This will not control insect infestations already in your stored foods.

Spray the shelf surface with 0.5% chlordimefox (Dursban), 1% propoxur (Baygon), 0.5 percent diazinon, or 0.25 percent resmethrin. You can find any of these in the hardware store in ready to apply packages. If a sprayer isn't feasible then they can be applied with a paint brush. Allow the solution to dry thoroughly. Cover the shelves with clean, untreated shelf paper and put properly packaged foods back on shelves. READ THE PRODUCT LABEL FOR SAFETY INFORMATION CONCERNING CHILDREN AND PETS.

Household bleach, Lysol and other sterilizers will not control insect infestation, though they can be used for mold, mildew and algae.

You may continue to find some insects after the cleanup is finished. This could be for several reasons. The first being they escaped from the packages they were infesting and did not get cleaned up. There may be more packages infested than were originally realized or, there may be hiding places in the storage area that need attention. Once you have carefully eliminated all food sources, the bugs should disappear in three to four weeks.

#### B -- MOLDS IN FOOD

Molds are fungi just like mushrooms and yeast. Also like mushrooms, they reproduce by releasing spores into the air that land on everything,

including your food and food storage containers. When those spores begin to grow, they create thin threads that spread through out their growing medium. These threads are the roots of the mold fungus, called mycelium. The stalk of a mold fungus is the portion above or on the surface of the food. It produces the spores and gives the mold its color. We've all seen examples of this when we discover a dish of something or other left way-y-y too long in the refrigerator and has become covered in mold fuzz.

Molds can grow anywhere they have a growing medium (their food), sufficient moisture and enough warmth. Some can even grow at refrigerator temperatures, albeit more slowly than they would if it were warmer. They can also withstand much more salt and sugar than bacteria, which is why you sometimes find mold in jellies and jams with their high sugar content and on cured products like ham or bacon with their high salt content.

In the past, it was often felt a slight amount of mold was harmless and the food could be consumed anyway. For molds that were intentionally introduced into the food, such as the mold in bleu cheese, this is just fine. For the unintentional molds, it can be a very serious error in judgment. These unwanted molds might just be producing a toxic substance called a "mycotoxin" which can be very bad indeed. Mycotoxins are produced around the root or mycelium of the mold and the mold roots can penetrate very deeply into the food. These mycotoxins can survive for a long time in foods, and unfortunately most are not destroyed by cooking. The molds probably best known for this are the various *Aspergillus* varieties which produces a mycotoxin known as "aflatoxin", but there are other dangerous molds as well, such the *Fusarium* molds. Both of the above affect grain and some legumes.

**IMPORTANT NOTE:** In wet pack foods such as your home canned goodies, molds can do something else, possibly leading to lethal consequences. If they are present in wet pack food by reasons of improper procedure or contamination after the fact, they can consume the natural acids present in the food. The effect of this is to \*raise\* the pH of the food in the container, perhaps to the point that it becomes possible for spores of *Clostridium botulinum*, better known as "botulism", to become active and reproduce. If you're not already aware of the consequences of botulism poisoning, please read the bacterial spoilage section below where it has an entry all its own. There are few kinds of food poisoning with as deadly serious consequences. For this reason, moldy wet pack foods should be safely discarded.

#### B.1 MINIMIZING MOLDS

You can do a number of things to minimize unwanted mold growth in your kitchen, food storage areas and refrigerators. If your kitchen is at all like mine, it is the refrigerator that is going to collect the most fungal growth. This can be dealt with by washing the inside every couple of months with a tablespoon of baking soda dissolved in a quart of warm water. Rinse clean and allow to dry. The black mildew that grows on the rubber door gaskets and other places can be dealt with by wiping down with a solution of three tablespoons of household bleach in a quart of water. I generally use a soft bristle brush for this.

The rest of the kitchen can be kept mold free by keeping it clean, and dry and by spraying occasionally with a product such as Lysol. Patches of mold growing in spots can be eliminated with the bleach solution used on the refrigerator doors.

Try not to purchase more fresh food than you'll be able to eat in a short period of time. This will keep you from having to deal with the moldy remains that didn't get eaten. If food does go moldy, \*don't sniff it\*. This is a good way to give yourself respiratory difficulties if you are at all susceptible to mold allergies. Moldy food should be disposed in such a manner that your animals and children won't be able to get into it. Mycotoxins are every bit as bad for your animals as they are for you.

Obviously, you don't have to throw out everything that shows a spot of mold on it. Some foods can be safely dealt with and still partially saved if they show signs of fungal growth. Below is a set of guideline from M. Susan Brewer, Ph.D., R.D., a specialist in food safety. Her articles and works are found in many state university extension services publications lists.

If the food shows even a tiny mold spot, follow these guide lines:

1. Hard or firm foods with tiny mold spots can be trimmed; cut away the area around the mold (at least an inch) and rewrap in clean wrap. Make sure that knife does not touch the mold.
2. Soft foods such as cheese slices, cream cheese, sour cream and yogurt should be thrown away.

TOSS:

Soft Cheeses, (Mozzarella Brie)  
Sour Cream, Yogurt, Cottage cheese  
Bacon, Hot dogs, Sliced lunch meats  
Meat pies  
Opened canned ham  
Most left-over food  
Bread, Cakes, rolls, flour, pastry  
Peanut butter  
Juices, berries  
Jam, Jellies, Syrups  
Cucumbers, Tomatoes  
Spinach, Lettuce, other leafy vegetables  
Bananas, Peaches, Melons  
Corn-on-the-cob  
Stored nuts, whole grains, rice

TRIM:

Hard Cheese (Cheddar, Swiss)  
Bell Peppers, Carrots, Cabbage  
Broccoli, Cauliflower, Brussels Sprouts  
Garlic, Onions  
Potatoes, Turnips

Zucchini  
Apples, Pears

#### B.2 MOLDS IN CANNED GOODS

If good equipment and proper technique are used, then it is unlikely you will ever have mold growth in your unopened canned goods. If you do have such, then there was either a flaw in the procedure you used, or something affected the jar or can after the fact to break its seal. In any event, once the food has molded, it is past saving and should be discarded in such a way that children and animals will not be able to get into it.

The most likely home canned products to show mold growth are jams and jellies sealed with paraffin wax. There are a number of points in the canning process where this can occur. 1 - in the time after the jar is taken out of its boiling water bath, but before it is filled, 2 - in the time between when the jar is filled and covered with the melted wax, 3 - when the wax cools, if it pulls away from the side of the jar, leaving an opening for the mold to get in, and 4 - if bubbles form in the paraffin, which break and leave holes. It is for this reason that most canning authorities no longer recommend using this technique. If you must use it, the jelly jars should be boiled for at least 10 minutes before the jelly is poured into the jars. The filled and wax capped jars should then be covered with some sort of protective lid. The book, \*Putting Food By\* has excellent instructions on this or see the applicable section of the rec.food.preserving FAQ by Leslie Basel.

#### B.3 MOLDS IN GRAINS AND LEGUMES

It's long been known that eating moldy grain is bad for your health. The ugly consequences of eating ergot-infected rye probably make the best known example. It's only been for about thirty years, though, that intensive study of these grain fungi have been carried out on other varieties of molds and their respective mycotoxins. Fortunately, for those of us in the U.S., the USDA and the various state departments of agriculture go to a great deal of trouble to detect grain and legumes infected with these toxic fungi. In some of the less developed countries, the citizenry are not so lucky. Still, it is good to have something of an understanding of what one should do to prevent mold growth in one's stored grains and to have an idea of what to look for and ask about when purchasing grains and legumes.

The one fungal type that has caused the most commotion in recent history are the various *Aspergillus* species of molds. Under certain conditions with certain grains, legumes and to a lesser extent, nuts, they can produce a mycotoxin called "aflatoxin". This is a serious problem in some parts of the world, most especially in peanuts, occasionally in corn. There have been no deaths I am aware of in the United States from aflatoxicity, though other countries have not been so fortunate. What makes aflatoxin so worrisome in this country is that it is also a very potent carcinogen (cancer causing agent).

In addition to the *Aspergillus* molds, there is also a very large family of molds called *Fusarium* and these can produce a wide variety of

mycotoxins, all of which you do not want to be eating directly or feeding to your animals where you will get it indirectly when you eat them.

The Federal government and the various state governments continuously monitor food and forage crops. Those products which are prone to mold growth and toxin production are not allowed to be sold for food. Once purchased however, it is up to you to keep your food safe from mold growth. If you have already found mold growth in your whole grains, meals, flours or other grain products, they should be discarded. Most mycotoxins are not broken down or destroyed by cooking temperatures and there is no safe way to salvage grain that has molded.

#### B.3.1 PREVENTING MOLD GROWTH IN STORED GRAINS AND LEGUMES

The easiest method to prevent mold growth in your stored grains and legumes is simply to keep them too dry for the mold to grow. The Aspergillus and Fusarium molds require moisture contents of 18% and above to reproduce. This is subject to some variability, but in all grains and soybeans, they must have a moisture content of that level. If you are storing raw (not roasted) peanuts, in the shell or shelled, you want to get the moisture content to less than 8% as peanuts are particularly susceptible to mold growth. The recommended moisture content for all other grain and legume storage is no more than 10%. (Please see part 2.A.3.1 Grains and Legumes for a method to determine moisture content.) At 10% moisture, it is simply too dry for fungi to grow. (Please see 1.A.4 STORING GRAINS AND LEGUMES for a suitable packaging technique.)

#### C -- BACTERIAL SPOILAGE

Just like the fungi, bacteria are everywhere. They're in the water, soil, air, on you, your food and your food storage containers. Fortunately, the vast majority of the bacteria we encounter are relatively harmless and only a few represent a danger to us and our stored foods.

Bacteria can be very much more difficult to kill off than molds and insects. Some of them are capable of continued growth at temperatures that would kill other spoilage organisms. When conditions are such that they are unable to grow, some bacteria can go dormant and form spores. These spores can be quite hardy, even to the point of surviving a rolling boil.

In order to grow, bacteria need moisture, some as little as a 20% moisture content. For dry grains, legumes, powdered milk and other low moisture foodstuff bacterial spoilage will seldom be a problem so long as the moisture level in the foodstuff remains too scant to support its growth. For this reason, it is imperative that such products be drier than 20% and preferably below 10% to ward off mold growth as well. The botulism bacteria need moisture in the 35% range to grow. Thus, using desiccants in your food packaging is also an excellent idea.

WARNING: It is in wet pack canned goods (where the container has free liquid in it) and fresh foods we must be the most concerned

about spoilage bacteria. It is here that a little bad luck and a moment's inattention to what you are doing could kill or seriously injure you or some other person who eats the foods you've put by. In both home-canned and commercially-canned goods, IF THE CAN IS BULGING, LEAKING, SMELLS BAD, OR SPEWS LIQUID WHEN YOU OPEN IT THEN THROW IT OUT! But, throw it out safely so that children and animals cannot get into it.

#### C.1 BOTULISM

*Clostridium botulinum* is one of the oldest types of life forms found on the planet. Like the gangrene bacteria, it is an anaerobic organism meaning it lives and grows in the absence of free oxygen. It forms spores when conditions are not suitable for it to grow and it is commonly found in the soil. This means it can be brought into your life on raw produce, tools, hands or anything else that came into contact with dirt. To further complicate matters, botulinum spores are extremely heat-hardy. The bacteria itself can be killed by exposing them for a short time to boiling water (212 F AT \*SEA LEVEL PRESSURE\*), but their spores can not. To kill them, the food product and container must be exposed to temperatures of 240 F (AGAIN AT \*SEA LEVEL PRESSURE\*) for a long enough period of time to allow all of the food in each container to come completely up to the proper temperature. Only a pressure canner can reach the necessary temperature.

It's not the bacteria or its spores which are directly deadly, but the toxin the bacteria creates when it grows and reproduces. In its pure form, botulism toxin is so potent that a mere teaspoon of it would be enough to provide a fatal dose to hundreds of thousands of people. It is this lethality that is why every responsible book on canning, food preservation, food storage, and the like hammers constantly on the need for care in technique and method and why spoilage must be taken so seriously.

*C. botulinum*, like any other life form, must have suitable conditions for it to grow and become a danger to you. One of the conditions it must have is a suitable pH range in its environment. pH is the measure of the acidity or alkalinity of a substance and is measured on a scale of 1-14 with anything above 7 being considered alkaline and everything below 7 being considered acid. If the pH of your wet pack food is BELOW 4.6 then botulism is unable to grow. Keep in mind pH is not eternal in foods and it is possible for it to change. If it should change to a lesser acidity than 4.6 pH your previously botulinum proof food may start allowing the lethal spoiler to grow (see B.2, molds in canned goods). This is why it is vital to use proper technique, even for acid foods like tomatoes. It has been found that when this occurs and botulinum becomes active and produces its lethal toxin it also produces minute amounts of acid which can lower the pH of the poisoned food back into what should have been the safe zone had the pH not jumped up and allowed the bacteria to grow. Again and again -- use good technique and pay attention to what you are doing.

Botulinum toxin, unlike fungal mycotoxins, can be destroyed by boiling the food briskly in an open vessel for fifteen minutes. Because of this, if your canned food shows \*any\* safety problems you should follow this procedure. If the food shows even the slightest mold

growth, keep in mind that mycotoxins are not for the most part broken down by heat and dispose of the food safely.

I don't intend to go into the hows of home canning here. For that I strongly recommend that you read sections 1, 4, and 5 of the r.f.p. FAQ and most especially the book \*Putting Food By\* for in depth information on this subject.

#### C.2 OTHER BACTERIAL SPOILERS

This section will be in a future version of this FAQ.

#### D -- ENZYMATIC ACTION IN FOOD SPOILAGE

Every living organism uses enzymes of many sorts in its bodily functions as part of its normal life cycle. Enzymes are used in creating life. After death, enzymes play a role in the decomposition of once living tissue. The enzymes in a tomato help it to ripen and enzymes produced by the tomato and whatever fungal and bacterial spoilers are on it cause it to decay.

Fortunately, slowing down or stopping the action of a food's enzymes is much easier to do than slowing or stopping some of the bacterial spoilers mentioned above. Enzymes are most active in a temperature range between 85 to 120 F and begin to be destroyed when the temperature goes above 140 F. Cold also slows down the action of enzymes, which is why fresh tomatoes last longer in the refrigerator than they do on the kitchen table. Most enzymatic action also requires moisture to occur. In foods stored at 10% moisture or less, there is not enough moisture for most enzymes to be active.

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#### IV -- SPECIFIC EQUIPMENT QUESTIONS

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#### A -- STORAGE CONTAINERS

OK, I'm ready to start my food storage program. What should I put the food in?

You should use food grade containers for storing anything you intend to eat. A food grade container is one that will not transfer non-food chemicals into the food and contains no chemicals which would be hazardous to human health. If you are uncertain whether a container is food-grade or not then contact the manufacturer and ask if a particular container is approved for food use. Many manufacturers are beginning to indicate on the container label if it is approved for food use.

##### A.1 PLASTIC CONTAINERS

###### A.1.1 WHAT MAKES A PLASTIC CONTAINER "FOOD GRADE"?

Plastic films and containers of food grade quality are made from polycarbonate, polyester or polyethylene. Their characteristics in terms of density, permeability and strength vary. To limit permeability to moisture and oxygen, films of the above plastics are sometimes laminated together, frequently with a metallic layer. Military food packaged in just such a metallized polyester, polyethylene wrap has a long shelf life (5+ years) if kept cool.

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From: Denis DeFigueiredo <ddefig@newhall.com>  
Originally posted in: rec.food.preserving

I called Berlin [eds. note, a plastic container mfgr. 1-800-4-BERLIN] and spoke to them, plus an outfit called Kirk Container (they manufactured some 5 gallon paint buckets I saw in the local hardware store). Both places said that buckets made from High Density PolyEthelene are approved for food. It has to do with the possibility of interaction between any chemicals in the food and the plastic. As it turns out, Kirk manufactures only one kind of bucket, and then markets it for paint, hardware, food, etc. The price is right on the "paint buckets" - much cheaper than the local restaurant supply house.

High density polyethelene buckets will have HDPE stamped on them, or a recycle symbol with a "2" in the middle.

DISCLAIMER: I'm only passing on information I received from the manufacturers. I am in no way professing these things to be absolute fact!

#### A.1.2 WHERE DO I FIND FOOD GRADE CONTAINERS?

From: "Jenny S. Johanssen" <johanssen@matnet.com>  
Originally posted in: rec.food.preserving

Denis - saw your comments on food grade buckets and thought I'd offer my solution. My son cooks at a local Mexican restaurant. They get all their strawberries (for the strawberry magaritas at the bar) in 3 gallon plastic buckets. Now you know how many margaritas pass through a Mexican bar each night - lots. So I asked my son to save me some buckets. They are ideal for storing flour, rice, I made (from my home grown raspberries) a delicious raspberry cordial in one of the buckets, another I made Raspberry wine in. My motto is why buy when you can recycle! Thanks for giving me the time and space to add my two-bits worth. - Jenny

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From: Woody Harper <lager@primenet.com>  
Originally posted: rec.food.preserving

...I get topping buckets from Dairy Queen and I have to make sure there is no trace of the strawberry syrup left. A little detergent and elbow grease followed by a chlorine solution bath keep everything nice and clean.--

#### A.1.3 HOW DO I GET THE ODOR OUT OF PICKLE BUCKETS?

I've had fairly good luck doing it this way. Since vinegar is the primary smell in pickles and it's acidic, we used a base to counteract it. First we scrubbed the bucket well, inside and out, with Dawn dish detergent. I imagine most any sort will do. Then we filled the buckets with hot water and dissolved a cup of baking soda in each. Stir well, get the bucket as full as you can and put the top on. Put the bucket in the sun to keep it warm so the plastic pores stay open as much as possible. In a couple of days come back and empty the buckets. Rinse them out, fill with warm water again and add about two cups of bleach and reseal. Put back in the sun for another couple of days. Empty out and let dry with the tops off. We completely eliminated the vinegar smell this way. It might be possible to cut the time down a lot, but we haven't experimented that much since we can't get that many pickle buckets.

#### A.2 METAL CANS

The metal cans used by the canning industry for wet-pack canning are designed to last only a few years. Most losses of canned foods occur due to the breakdown of the can rather than extensive deterioration of the food under normal storage conditions.

The major disadvantages of metal cans for putting up your own food are that the cans are hard to come by, they take specialized equipment to use (but so do glass jars) and they can only be used once to seal in food. Not being reusable is the flaw that has largely made them unpopular for home canning use. Since they're not interested in reusing the containers, metal cans make great sense for the commercial canning industry. The cans are both cheaper (for them) and lighter than glass jars and this adds to the economy of scale that makes canned foods as cheap as they are in the grocery store.

For home canners, glass jars are better because even the smallest of towns will usually have at least one store that carries pressure and boiling water canners along with jars, rings and lids. With tin cans, however, a can sealer is necessary and that usually has to be ordered from its manufacturer.

Tin cans are not really made of tin. They're actually steel cans with a tin coating on the inside and outside. Some kinds of strongly colored acidic foods will fade in color from long exposure to tin so a type of enamel liner called "R-enamel" is used to forestall this. Certain other kinds of food that are high in sulfur or that are close to neutral in pH will also discolor from prolonged contact with tin. For those foods, cans with "C-enamel" are used.

The excellent food preservation book, \*Putting Food By\* Chapter 6 (see reference list) has a section on the use of tin cans for wet packed foods.

##### A.2.1 THE CHURCH OF JESUS CHRIST OF LATTER DAY SAINTS - THE MORMONS

There is one way that metal cans do make economic sense to use and that is by pooling community resources to purchase the can sealer and

the cans. The LDS church does just this in their family canneries and have, in fact, almost exclusively gone over to using metal cans from all other containers. This is done primarily for dry-pack canning. Those areas that do wet-pack canning primarily use canning jars. By sharing the cost of the equipment and purchasing the cans in bulk quantities to reduce cost to the lowest possible level, the advantage of metal cans over plastic containers can then begin to outweigh the disadvantages.

If properly protected from corrosion, metal cans are gas-impervious and immune to rodent attack, qualities that plastic containers are weak on. The cans still aren't resealable, other than with a plastic lid, after they're opened, but for a one time use they're pretty tough. Of course, there is still the oxygen and moisture that is trapped inside to deal with, and the heat of the storage area they're kept in, but this is common to all food storage regardless of the container.

It may not be necessary to form your own community to purchase a dry-pack can sealer and bulk quantities of metal cans. If you live in the right area your local LDS church may have facilities they will allow you to use and perhaps even suitable food products they will sell you.

Most facilities will be located at one of the LDS Bishop's Storehouses located in various places around the country, but some churches also have their own local facilities. The easiest means of finding out is simply to ask the LDS church member you know. If they don't themselves know, or you don't know any Mormons then a little phone book research will be necessary. Find your nearest local Mormon church and ask about speaking with the local Bishop of the Ward or Relief Society president. Either one of those two individuals will be able to give you the information you seek.

**IMPORTANT NOTE:** Please do keep in mind that the individuals responsible for the family canneries are all volunteers with demands on their time from many areas. Be courteous when speaking with them and, if there are facilities for use, flexible in making arrangements to use them. You will, of course, have to pay for the supplies that you use, cans and lids at the least, and any food products you get from them.

Any food products you want to have sealed in cans will need to fall within their guidelines of suitability for that type of packaging. This is for reasons of spoilage control since many types of foods just aren't suitable for just sealing in a container without further processing. If you purchase food products from them, they will already be within those guidelines.

I've corresponded with many LDS members and have even contacted the LDS headquarters in Salt Lake City to get the official word. Keeping in mind that not every area may have facilities for use and that the family canneries are run by volunteers, they are quite earnest about allowing non-church members to use their facilities. It's worth investigating.

See also IV.C.2 Preventing Corrosion of Canned Goods.

#### A.3 GLASS JARS

Compared to metal cans, glass jars are very stable, although they don't take being banged around very well. The cardboard boxes the jars come in are well designed to cushion them from shocks. The box also has the added bonus of keeping out damaging light.

The major advantage of glass jars is that they are reusable, both jars and rings, with lids being the only part of the package that must be purchased new for every use. If you're not using the lids to form a vacuum seal such as would happen when doing boiling water or pressure canning then even the lids can be reused.

When you get right down to the bottom line, it is seldom practical strictly in terms of dollars and cents to put up your own food in jars. When you count the cost of your equipment, including the jars, rings, lids and all the rest, along with a not inconsiderable amount of your personal time, the cost of purchasing or growing your produce, you'll almost always come out ahead to buy food canned for you by the commercial canning industry. That said, forget about the strict bottom line and examine more closely why you want to put up your own food. For many, gardening is a pleasure and they have to have something to do with the food they've grown! There's also the fact that for many, you simply cannot buy the quality of the food you can put up for yourself. The canning industry tries to appeal to a broad spectrum of the general public while you can put up food to your own family's specific tastes. Home canning is not so much about saving money as it is about satisfaction. You get what you pay for.

If home canning appeals to you, please allow me to point you toward the rec.food.preserving FAQ where much very good information about methods and techniques may be found.

One source of gallon sized glass jars are sandwich shops and restaurants that use pickled peppers. I have a Subway (tm) sandwich shop that saves its pepper jars for me and receive several per week.

## B -- CO<sub>2</sub> AND NITROGEN

### B.1 DRY ICE

Using dry ice to displace oxygen from food storage containers is a very straightforward affair. To prevent leaching plastic chemicals from the container into your food over a long period of time I recommend lining the bucket with a food grade plastic, mylar or brown paper bag before filling the bucket with your product. Be sure to wipe any accumulated frost off of the ice and wrap it in a paper towel or something similar so you don't burn anything that comes into contact with it. Put the dry ice at the bottom and fill the container. Shake or vibrate it to get as much density in the packing as possible and to exclude as much air as you can. Put the lid on, but do not fully seal it. You want air to be able to escape. Ideally, the dry ice should slowly evaporate and the cool CO<sub>2</sub> should fill the bottom of the bucket, displacing the warmer, lighter atmosphere and pushing it out the top of the container. One pound of dry ice will produce 8.3 cubic feet of carbon dioxide gas so about four ounces per five gallon bucket is plenty. Do not move or shake the bucket while the dry ice is sublimating. You want to keep mixing and turbulence to a minimum. After

about three hours go ahead and seal the lids, but check on them every fifteen minutes or so for an hour to be certain that you're not getting a pressure build up. If you don't have to let any gas off, then put them away. A \*little\* positive pressure inside the bucket is a good thing, but don't allow it to bulge.

**WARNING:** Dry ice (frozen carbon dioxide) is \*extremely\* cold and can cause burns to the skin by merely touching it. Because of this you should wear gloves whenever handling it. Also, dry ice evaporates into carbon dioxide gas, which is why we want it. CO<sub>2</sub> is not inherently dangerous, but you should make sure the area you are packing your storage containers in is adequately ventilated so the escaping gas will not build to a level dangerous enough to asphyxiate you.

**IMPORTANT NOTE:** Because dry ice is very cold, if there is much moisture in the air trapped in the container with it, and your food, it will condense. If there's enough of it, it's going to cause you problems. Try to pack your containers on a day when the relative humidity is low or in an area with low humidity, such as in an air-conditioned house. Use of a desiccant package when using dry ice to purge storage containers is a good idea.

#### B.1.1 DRY ICE SUPPLIERS

Dry ice may be found at ice houses, welding supply shops, some ice cream stores, meat packers or you could look in your local phone book under the headings "dry ice" or "gasses".

### B.2 COMPRESSED NITROGEN

#### B.2.1 TYPES OF AVAILABILITY

Both nitrogen (N<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) are commonly available in the form of compressed gas in cylinders. Of the two, nitrogen is the more inert and thus to be preferred. In food storage, CO<sub>2</sub> is mainly used in the form of dry ice (see above) which is often easier to acquire with much less equipment needed to use it. Because of this, I'll be limiting this section to the use of compressed nitrogen. If for some reason you prefer to use compressed CO<sub>2</sub>, the information given below will work for it as well, though cylinder sizes may differ.

In the U.S. there are about eight principal suppliers of compressed gasses: Air Liquide, Airco, Linde, Air Products, Matheson, Liquid Carbonic, MG Industries, and Scott. One or more of these producers should have compressed gasses available in virtually every area of the United States and Canada.

Locating a source of compressed nitrogen is probably as easy as looking in your local phone book under the headings "compressed gas suppliers", "gasses", or "welding supplies". Other sources might be automotive supply houses, university or college research departments, vo-tech schools, and medical supply houses.

Nitrogen is generally available in a number of forms ranging from gas intended for welding, to various purity assured types, to gas

mixtures where N<sub>2</sub> would be one of the components.

Unless you are very knowledgeable about compressed gasses and the equipment needed to use them it is \*strongly\* recommended that you not use any gas \*mixtures\* in your food storage, but rather to stay with pure nitrogen gas. Use of compressed gas mixtures requires knowledge and equipment beyond the scope of this FAQ.

NOTE: Welding nitrogen is essentially a pure gas, but it has one important caveat. When a cylinder of welding gas is used there is an unknown possibility that some form of contaminant may have backfed into the cylinder from a previous user. Possibly this could happen if the tank was being used in an application where the cylinder's internal pressure fell low enough for pressure from whatever the tank had been feeding to backflush into the cylinder. Alternatively, the tank pressure may have become depleted and was repressurized using ordinary compressed service air. The most likely contaminants will be moisture, carbon monoxide, carbon dioxide, oxygen and hydrocarbons, but there is the remote possibility of something even more exotic or toxic getting into your cylinder. Welding gas cylinders \*may not\* be checked by the gas supplier before being refilled and sent back out for use. It is this remote, but unknown possibility of contamination that causes me to recommend against the use of welding grade nitrogen in food storage.

The varying types of purity assured nitrogen gas are slightly more difficult to find and slightly more expensive in cost, but I believe this is more than made up for by the fact you know exactly what you're getting. Air Liquide, as an example, offers seven types of purity assured nitrogen ranging from 99.995% to 99.9995% pure with none having a water vapor content over 1 part per million (ppm) or an oxygen content over 3 ppm. Any of them are eminently suited to the task so the most inexpensive form is all you need buy.

As you might expect, compressed gas cylinders come in a number of different sizes. For the sake of simplicity I will address only the most common cylinder sizes since they will almost certainly be the most inexpensive as well.

Again using Air Liquide as an example, it is their size 44 and 49 cylinders that are the most common. There are other cylinder sizes of smaller physical dimensions and capacities. However, the logistics of compressed gas production and transport being what they are, they frequently will cost as much or even more than the larger, more common sizes. The actual gas inside the cylinder is fairly cheap. Filling and moving the heavy cylinders around is not.

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Table 1. Air Liquide most common cylinder sizes.

Cyl Size	Cap Cu Ft	Cap PSIG	Filled Wt Lbs	Ht In	Dia In
44HH	445	6000	339	51	10
44H	332	3500	225	51	10
49	304	2640	165	55	9.25
44	234	2265	149	51	9

16      77      2000      71      32.5      7

Legend:

The "H" suffix means high pressure.

PSIG = Pounds per Square Inch on the Gauge, this does not reflect atmospheric pressure which would be Pounds per Square Inch Absolute (PSIA). PSIA is the absolute pressure of atmospheric and internal cylinder pressure combined.

Although it is not a very common size, I left the #16 cylinder in the above table in case someone really wants or needs to use a smaller cylinder.

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Table 2. Cylinder Size Comparison. Abbreviated table.  
(Alphagaz in Column 1)

Cyl Size [1]	Air Airco [2]	Air Prod [3]	Liq Linde [4]	Liq Carb [5]	MG Math [6]	MG Ind [7]	MG Scott [8]
49	300	A	T	J	1L	300	K
44L	200	-	K	H	1A	200	A
44	200	B	-	-	-	-	-
44H	-	BY	3K	-	1H	2HP	-
44HH	500	BX	6K	-	1U	3HP	-
16	80	C	Q	M	2	80	B

Legend:

- [1] Alphagaz (Air Liquide)
- [2] Airco
- [3] Air Products
- [4] Linde
- [5] Liquid Carbonic
- [6] Matheson
- [7] MG Industries
- [8] Scott

Reference: "High Purity Specialty Gases and Equipment" Catalog,  
copyright 1995, Air Liquide America Corporation, Houston TX USA;  
pages 6 and 7.

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As you can see, the size 49 cylinder from Air Liquide has an equivalent from all eight manufacturers. This size is the one commonly seen being used to fill helium balloons at county fairs and ball games.

### B.2.2 OBTAINING THE GAS AND NECESSARY EQUIPMENT

Although you can purchase your own cylinder the most inexpensive way to use nitrogen is to rent a cylinder from your gas supplier. This may require filling out an application, paying a refundable cylinder deposit and buying the gas contained in the cylinder. Tank rental periods can vary, but the most common is for thirty days.

Having rented or purchased the cylinder you must now get it home. Delivery by the supplier can often be arranged or they may assist you in getting the cylinder into your vehicle. The preferred method of transportation is for the cylinder to be chained, clamped or otherwise solidly secured in a vertical position in the transporting vehicle with the cylinder cap in place. Transportation requirements vary from nation to nation, state to state and even city to city so your best bet is to inquire of your gas supplier to find a safe and legal means of moving the tank.

**IMPORTANT NOTE:** The major expense in using compressed gas is not the cost of obtaining the gas itself, but in the equipment needed to safely handle and control it. Unless you can borrow the appropriate mechanisms they will have to be purchased, new or used, and even the cheapest regulator and gauge is not inexpensive. There is a temptation to forgo the expense and not use a regulator, but I must caution strongly against this. As table 1 above shows, a full cylinder of compressed gas will have an internal pressure of 2000+ PSIG. Normal atmospheric pressure is about 15 PSIA. If the cylinder valve was opened only slightly too far a great deal of very high pressure gas will flow through the delivery hose and metal wand and the potential for serious injury when it began to whip around would be very great. For your safety, get the necessary equipment. If you purchase your own regulator/gauge cluster and/or your own cylinder, there is necessity for periodic maintenance. Regulators and gauges need to be calibrated (using a water deadweight calibrator) and cylinders need to be hydrostatically tested, typically every ten years for both. Your gas supplier can provide you with more detailed information.

The only equipment that will come with your cylinder is the cylinder cap. "Don't leave home without it" and they mean it. All of the common cylinder sizes will use the CGA-580 (Compressed Gas Assembly) cylinder fitting. The downstream side of this fitting can be obtained with different threads, but a 1/4" NPT (National Pipe Thread) nipple is normally needed to mate with the regulator body. The nipple is really nothing more than just a short length of high pressure pipe. The CGA fittings come in a variety of metal compositions such as carbon steel, stainless steel and brass. The best choice is one which matches the composition of the regulator body. If the CGA fitting and regulator are to be used \*only\* with dry, non-oxygen gasses, in a dry environment then galvanic corrosion can be disregarded so the most inexpensive metal composition can be used even if it is not the same as the regulator. If it is to be used in a wet area, or with oxygen containing gasses then matching metal composition becomes very important.

When the tank is to be returned there **\*must\*** be some residual pressure still in the cylinder or the renter might have to pay a

surcharge or lose their deposit. This is particularly true of purity assured gasses because the residual gas composition will be analyzed. This is done for the safety of all cylinder users.

The regulator/gauge cluster should be carefully removed using the same procedure that is described below to put it all together. Care should be taken not to damage the cylinder valve threads. Replace the cylinder cap and transport in the same manner as you brought it home.

#### B.2.3 PUTTING IT ALL TOGETHER

If the fitting and regulator are bought separately then some 1/2" wide Teflon (tm) tape is recommended for assembly since it is a clean and inexpensive way of sealing pipe joints. Looking into the open end of nipple wrap the tape clockwise around the threaded end for 1.5 to 2 turns, working from the open end backwards. If you want to do a neat looking job, the tape may be slit lengthways to make it 1/4" wide, but this is not a requirement. A brass nipple may shrink somewhat during tightening and need a bit more tape than a harder metal like stainless steel would. The Teflon tape should \*only\* be used on the end of the nipple that attaches to the regulator body, NOT to any part of the cylinder end.

The regulator end has tapered threads and uses them directly for sealing. The cylinder end has straight threads and depends upon the precision mating of machined metal surfaces to seal. The cylinder end threads simply apply the clamping force.

Before attaching the CGA fitting to the cylinder the user should put on safety glasses and good hearing protection. The cylinder valve can then be cracked very slightly to blow out any dust or debris. After closing the valve, inspect the cylinder valve and nipple for any abrasions, nicks, gouges, embedded particles, etc., before attachment is made.

You will need \*two\* wrenches (not adjustable pliers) to equalize the torque, particularly on the cylinder valve where it should be minimized. Put one wrench on the fitting and the other wrench on the cylinder valve and make the join.

Once the regulator/gauge cluster has been mated to the cylinder, the delivery hose can now fitted to the regulator and the metal wand to the other end of the hose. The wand is nothing more than a short length of metal tubing at least six inches greater in length than the depth of the buckets to be filled. Copper water line works well.

When the joins have been made, a mixture of a short squirt of dish washing detergent and water can be used to check for leaks. Be certain the detergent does not contain ammonia. Pour some on each fitting working from the cylinder end outward, opening each valve and pressurizing as you go. Once the leak check is finished rinse off and wipe down all surfaces to minimize the chance of accidents in the future.

If the gas is not to be used at that time then the cylinder valve should be closed and all pressure should be drained to zero in the

regulator and gauge. This should be done any time that the tank is not in actual use. If you have purchased your own cylinder then it is a good idea to also acquire one of the plastic valve plugs, similar to those seen with propane cylinders, in order to protect the cylinder valve threads and keep dust, debris and insects out of the valve.

**WARNING:** Care should be taken that the cylinder is used and stored in such a way as to minimize the risk of the tank falling over. With the regulator and gauge attached there is an increased likelihood of damage occurring to the cylinder valve should the tank fall. Catastrophic failure of the cylinder valve will turn the tank into a high-energy, unguided rocket with the capability of doing great damage and/or serious injury.

#### B.2.4 PUTTING IT INTO USE.

Having assembled and tested your gas system, you are now ready to begin the work of packaging your food. You'll need containers, food grade plastic bags that are a bit larger in internal volume than the container, and some clean brown paper bags to fit inside the plastic bags. Next is the dry food you intend to package and a pack of matches or a cigarette. You'll also need to wear the safety glasses and hearing protection you wore when you put the gas system together.

Take the containers you are going to use to store your food in, the bags that will line them and the food you are putting up and place them in some warm (not hot) area long enough for them all to equalize to that temperature. This will mean that the air contained inside them will also be at a warm temperature and make it more likely that it will stay on top when the cool gas from the nitrogen cylinder begins to flow in. The warm gas being on top will be the first to purge from the container, taking a good deal of the oxygen with it.

Line the interior of the container with a plastic bag and then line the plastic bag with a clean brown paper one. Fill the container with the food product shaking to get it as full as possible. Don't forget to add your desiccant package if you're going to use one. You don't want any pockets left between the plastic bag and the container. Once you have gotten it full to just short of not being able to fully put on the lid, gather the top of the plastic bag together. Insert the wand to the bottom of the food, (take care not to tear the bags), and close the top of the plastic bag loosely around it. Now open the cylinder valve and set the regulator to a very slow gas flow and begin to fill the bags with gas. You want the container to fill \*slowly\* so you can minimize turbulence and mixing as much as you can. It'll take a little while to fill each container, a few minutes per bucket. Just as with dry ice, the idea here is for the cool gas to displace the warmer atmosphere from the container. The bags should puff just a bit. When I think it's full I'll hold a lit match just above the bag in the air that is escaping from it. If it snuffs right out then I let it run for about a minute longer to flush out more of any remaining oxygen and remove the wand.

Tie the bag off and seal the bucket. Again, you want to have the bucket as full as possible so that there'll be only minimal air space. You should monitor the containers for an hour or two after filling to check for any signs of bulging or other pressure build up as the cool

gas inside gradually warms up and expands. A slight positive pressure is OK, but serious bulging needs some of the pressure released.

NOTE: Although the procedure for flushing a container with nitrogen is straightforward enough, actually getting a good purge of the container is not. Nitrogen flushing works best when the contents of the container are fairly coarse in size so that the gas flow around and through the food is free and unrestricted. Foods such as the larger sized grains (corn, wheat, barley, long grain rice, etc.), legumes and non-powdered dehydrated foods are best suited to this technique. Foods with small particle sizes such as flours, meals, and dry milks will flush with mediocre results.

Because of the difficulties in purging sufficient oxygen from a container to lengthen the shelf life of the food it contains many commercial suppliers have dropped this technique in favor of using oxygen absorbers. There is no reason that inert gas flushing and oxygen absorbers cannot be used together and one good reason that they should. If you are using five gallon plastic buckets as your storage containers, it has been observed that the absorbers can cause the air pressure inside the bucket to drop enough for the walls of some buckets to buckle, possibly leading to a seal breach or a stack collapsing. For this reason, flushing with inert gas (nitrogen or CO<sub>2</sub>) might be a good idea, in order to purge as much oxygen as possible so that the pressure drop caused by the absorber removing the remaining oxygen will not cause the bucket to buckle.

## C -- OXYGEN ABSORBERS

### C.1 WHAT IS AN OXYGEN ABSORBER?

If all of this messing about with gasses sounds like too much trouble, you can try using oxygen absorption packets. I don't know exactly when they first showed up on the market for use by private individuals, but they are a relatively recent tool for long term food storage. The packets, one brand is Ageless Z300E from the Mitsubishi corporation, absorb free oxygen from the air around them and chemically bind it. This removes it from being available for other purposes such as oxidative rancidity and respiration by insects or bacteria. The practical upshot of all this is that by removing the free oxygen from your storage containers, you can greatly extend the storage life of the foods in the containers.

Finding any information about these absorbers has been difficult, but, thanks to Al Durtschi, I was able to find a study of their effectiveness from Brigham Young University.

The study tested the absorption capacity of the Ageless Z300E packets. It found they were even more effective than their rated absorption capacity of 300 milliliters of oxygen (O<sub>2</sub> at sea level pressure). A single packet sealed into an empty #10 can (80% of one gallon) reduced the oxygen in the canned air to less than 1/2%.

The following is the verbatim text of the conclusions section of the Brigham Young study. See V.B Pamphlets for the complete citation of this study.

## Conclusions:

"Oxygen absorbing packets are effective in reducing oxygen contents in sealed cans. The ageless Z300 packet has a greater than claimed capacity for absorbing oxygen. Packets abused by 4 hour-exposure-to-air still exceed claimed capacity. It may be economical to use smaller packets based on the dead air volume instead of can volume. Smaller packets would have less tolerance for abuse and personnel would need to be more diligent in protecting the packets."

"The level of oxygen remaining in the presence of the absorber packets is sufficiently low to greatly retard development of rancidity. The biological consequences are not so easy to predict. Microorganisms range from aerobic to anaerobic, thus no unqualified statement can be made. The energy requirements of anaerobic bacteria are met by reactions between oxygen and more than one other molecule. This makes bacterial energy a higher order of reaction than rancidity. Thus, the rate of bacterial aerobic reaction would be more seriously retarded than rancidity. These matters are not of practical importance because the products to be canned should be too dry to support microbial growth. Insects are aerobic and would like-wise suffer retardation of activity. No comprehensive statement can be made about irreversible inactivation or death of insects. As long as the oxygen level remains low, insect activity will be lower by at least the square root of oxygen content. In a practical sense, these packets are effective in stopping insect activity. USDA does not recognize any method except disintegration as effective for completely killing insect eggs."

## Use of Oxygen Absorbers in Dry Pack Canning

### C.2 WHERE CAN I FIND OXYGEN ABSORBERS?

Because they are a relatively new tool on the food preservation and storage market, oxygen absorbers have not yet achieved a widespread dissemination amongst the various storage food dealers and suppliers. They are available, but you may have to do a bit of searching to find them.

The following short list are the suppliers I've located, thus far, who sell them:

WALTON FEED  
RAINY DAY FOODS  
BEST PRICES STORABLE FOODS  
DOUBLE SPRINGS HOMEBREW SUPPLY  
LAKERIDGE FOOD STORAGE  
NITRO-PAK PREPAREDNESS CENTER

In addition to the above suppliers it may be possible to acquire oxygen absorbers through a LDS family cannery if you have one locally available. Please see section IV.A.2 for information on how to explore this possibility.

### C.3 HOW ARE OXYGEN ABSORBERS USED?

Even though they apparently will absorb a great deal more than the 300 ml of O<sub>2</sub> they are rated for, the following instructions for use are based on their listed rating. So, when using the Mitsubishi Ageless Z300E oxygen absorption packets, you should allow one packet for every quart and a half (1430 ml) of \*remaining air volume\* in your filled storage containers.

Now determining the volume of air remaining in a filled container is no easy thing. In the study, #10 cans filled with either elbow macaroni or powdered milk were used and their respective air volumes were determined. A can full of elbow macaroni was found to contain 22% remaining air volume and a can full of powdered milk was found to contain 10.5%. With these as guides, you should then be able to roughly figure the remaining air volume of the foods you have in your containers. You'll have to decide whether the food you are working is closer to the macaroni or the dry milk in its packing density. Obviously, this is a rather rough rule of thumb and this is why I kept my instructions to the listed ratings rather than on what they will apparently really do. The excess capacity will thus serve to cover the shortcomings of your reckonings. These absorption packets should be used only in dry foodstuffs and not with any product that will get them wet.

NOTE: If you do choose to use oxygen absorbers in packing your food storage containers you should give some consideration to the container you're using. The absorber is going to be removing the 20% of the atmosphere that oxygen constitutes. Since nothing is replacing it this will leave the interior of the storage container with a lower atmospheric pressure than the outside. If the container is sufficiently sturdy this pressure differential will be of little consequence. For containers with thinner walls or more flexible material the pressure drop could cause them partially collapse or buckle, particularly if other containers are stacked upon them. This could make them more likely to lose seal integrity. The sturdier plastic buckets (Superpails, etc), or metal cans should have no problems. Other containers should probably be tested or first flushed with an inert gas (N<sub>2</sub>, CO<sub>2</sub>) before the absorber is sealed in.

If anyone out there knows of more precise instructions for the use of these O<sub>2</sub> absorbers, particularly if they're from the manufacturer, I'd appreciate it if you'll send them to me. To date, the study that Al pointed out to me is the only solid data I've found. It is from it that I derived the instructions I have given above.

## D -- DESICCANTS

### D.1 WHAT IS A DESICCANT?

A desiccant is a substance with very hygroscopic (adsorbs moisture from the air) properties. There's any number of different substances that meet this description, but only some of them will serve our purposes.

The most commonly used desiccant is silica gel. This is an amorphous, highly adsorbent form of silica. It is most easily found in a form called "indicating silica gel" which are small white crystals looking much like granulated sugar with small colored specks scattered throughout.

Those specks are how we determine whether the gel is dry or has adsorbed all of the moisture it will hold. If the specks are blue, the gel is dry and capable of carrying out its moisture adsorbing mission. If the specks have turned pink, then the gel has adsorbed all it will and is now saturated. Part of what makes silica gel so useful is that it can be refreshed by driving out the adsorbed moisture so it can be used again. This is a simple as pouring the saturated desiccant into shallow pans and placing in a 250 F oven for no more than five hours until the colored crystals have once again turned blue. You can also do the same thing in a microwave. Stir thoroughly and repeat until dry.

Although I've never found anything that mentions this, apparently it is possible for silica gel to break down over time, or at least the colored crystals can. I had a five pound can stored in an outside shed here in Florida for several years before I opened it again to use some of it. Nearly all of the colored indicator specks had broken down and disappeared. I don't know if the gel itself was still good and with no way to reliably determine whether it was saturated or not, I discarded it. The can the gel was in was just cardboard and it gets \*very\* humid here in Florida so it really was very poorly stored. Under decent conditions it may not break down at all. (I've never heard of this occurring, anyway.)

There are other desiccants, but I am not familiar with any that can be used with foodstuffs. I know that Kearny recommends using a piece of gypsum wallboard as a desiccant in his expedient radiation meter in Nuclear War Survival Skills, does anyone know if this can be used with dry foodstuffs? How about other desiccants?

---

From: Pyotr Filipovich <pyotr@coho.halcyon.com>

Simple trick is to dry a piece of wood in the oven - and once it is bone dry (more than usual) then put it in your container and seal it. The wood will suck up any available moisture.

#### D.2 WHERE DO I FIND DESICCANTS?

I buy all of my silica gel at Wal Mart in their dry flower section where it is sold in one and five pound cans for flower drying. I've seen it sold the same way in crafts stores and other department type stores that carry flower-arranging supplies. You can also buy it from many other businesses already prepackaged in one form or another to be used as an absorbent. All of the desiccant that I've found packaged this way has been rather expensive (to me) so shop carefully.

#### D.3 HOW DO I USE DESICCANTS?

The key to storing many foodstuff for the long term is dry, dry,

dry. Available oxygen and storage temperature also play roles, but it is moisture content that determines whether you get usable food out in five years or not.

Therefore, the idea here is to have the food you want to put into storage as dry as possible before it goes in and then take steps to deal with any moisture trapped, generated or leaked into your storage containers.

Ideally, the foodstuffs you have on hand will be no more than 10% moisture. If this is the case then you can go ahead and seal them into your storage containers using the packaging method of your choice and have a reasonable expectation of your food staying in good condition.

If your storage foods aren't sufficiently low in moisture content then you'll need to reduce the water they contain. Wheat has been found intact in Egyptian pyramids where it had lain for several thousand years. It was the bone dry desert air and the cool interior temperature of the pyramids which kept it from rotting away. We can approximate that Egyptian climate by several methods.

The least involved method is to wait until the driest time of year for your location. If this doesn't suit, then turn your air conditioning on a little high. Bring in your buckets, lids, and the storage food. Let everything sit in a well-ventilated place where it's going to get plenty of cool from the a/c. I'd avoid anywhere near the kitchen or bathroom areas, as they put out a lot of moisture. Stir the food frequently to maximize moisture loss. About three days of cool, constant air flow and low humidity ought to dry things out a bit. Due to its highly odor absorptive nature, I would not do this with any dried milk products or other powdered foods, flours or meals. This method works best with coarse particles such as grain, legumes and dried foods.

If this won't do, you can place a large quantity of desiccant in your storage containers. Fill the remaining space with your food product and seal on the lid. After about a week, unseal and check the desiccant. If it's saturated, change it out with dry desiccant and reseal. Continue to do this until the contents are sufficiently dry. If it doesn't become saturated the first time, change it anyway before sealing the bucket permanently. You'd hate to find later it saturated in storage.

I use silica gel for practically everything. My usual procedure is to save or scrounge clear plastic pill bottles such as 500ct aspirin bottles. Fill the bottle with the desiccant (remember to dry the gel first) and then use a double thickness of coffee filter paper carefully and securely tied around the neck of the bottle to keep any of it from leaking out. The paper is very permeable to moisture so the gel can do its adsorbing, but it's tight enough not to let the crystals out. This way whatever moisture does inadvertently get trapped inside can be safely absorbed. It won't dry out a \*lot\* of moisture -- you still need to take steps to get everything as dry as possible before you pack it -- but it will take care of what little is left.

IMPORTANT NOTE: The indicating form of silica gel (has small blue specks in it) is not edible so you want to use care when putting together your desiccant package to insure that is does not

spill into your food.

I've never found any certain rule of how much silica gel to use to how much dry goods. For my purposes, I use about four ounces of gel to a five gallon bucket of dry grain and beans. If I think the moisture content is over 10% when I seal them, I'll go as high as a half pound. This might be ridiculous overkill, but in Florida everything is high in moisture because of our ever present humidity. For a one-liter bottle of dry milk I'll use about one ounce of silica gel rolled up in a paper cartridge made from a coffee filter. If you're familiar with them, it looks like a paper cartridge such as you'd use for black powder weapons. They fit nicely into the bottle and keep the gel in.

## E -- DIATOMACEOUS EARTH

### E.1 WHAT IS DIATOMACEOUS EARTH?

Diatomaceous earth is a naturally occurring substance comprised of the fossilized remains of marine diatoms. These diatoms are microscopic in size and are covered in sharp spines that make them dangerous to exoskeletal insects, but not to animals with internal skeletons. The spines of the diatom skeletons pierce the soft body tissues of insects between their hard exoskeletal plates and it is through these numerous microscopic wounds that the insect loses bodily moisture to the point of dessicating and dying. Creatures with internal skeletons such as humans, cattle and pets have means of resisting such damage and are not harmed. Thus, it is possible to mix a small amount of DE into your stored grains and beans to control insects without having to remove the dust again before you consume them.

### E.2 WHERE DO I FIND D.E. AND WHAT TYPE SHOULD I BUY?

IMPORTANT NOTE: There are actually two kinds of diatomaceous earth to be found on the market and only one of them is suitable for use as an insecticide to use in your stored grains. The kind that you DO NOT WANT is the type sold by swimming pool suppliers as a filtering agent. It has been subjected to a heat treatment that dramatically increases it's silicate content and makes it unsuitable for use with your foodstuffs. The type that you want is sold by a number of suppliers as a garden insecticide. Many organic garden suppliers will carry it. Read the label carefully to be certain no deleterious substances such as chemical pesticides have been added. An appendix with the names and addresses of some DE suppliers may be found in the food and equipment suppliers section.

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From: higgins10@aol.com (Higgins10)  
Originally posted in: rec.gardens

Good afternoon all. Diatomaceous earth is approved by the USDA as an animal feed additive, however I have found out that there are vast differences between various forms of diatomaceous earth. Some DE products may not be effective in controlling insects, while others may be harmful to humans and pets. The most important differences between individual forms of DE is the shape of the diatom, content of

Crystalline Silica, and the purity of the Silica Dioxide. The World Health Organization cautions that DE with a crystalline silica content of three percent or higher is dangerous to humans, (and probably pets and birds as well). Diatomaceous Earth used in swimming pool filters has close to a 60% crystalline silica content. I know of a product called Organic Solutions (insecticide) which is approved by both the EPA and USDA and has a crystalline silica content ranging between 0.36% to 1.12% according to its labels etc. It is classified as Amorphous fresh water Diatomaceous Earth (whatever that means). However, all literature I have read assures it is safe for both humans and animals and seems to be very effective at killing insects. I stumbled across all this info. while shopping in the mall. If you're interested in reading it too, go to the Organic Solutions website at <http://www.BuyOrgs.com>. Hope this helps answer the question and always use environmentally safe products!

Higgins10

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From kahless@ns.waymark.net Sat Aug 24 14:08:48 1996  
To: Dunross (A.T. Hagan) Private e-mail

[previous text deleted]

I have always purchased DE at the local feed store. It's cheaper there than at the garden and hardware stores. The feed store I buy at has DE available in bulk, but they'll package up a smaller amount if that's what you want. My package in the garage doesn't have a brand name but says Nitron Industries at the bottom. The label recommends 7 pounds of DE for each ton of grain. Ha! As if I had "tons" of grain in storage 8-D

I've been using DE for grain storage for about 15 years now but flea control only for the past 6 years. The only fleas we've seen in that period of time is the ones that hitch a ride in with friends pets. A very light dusting afterward takes care of that problem. Miracle stuff as far as I'm concerned since we'd had an awful time with fleas before we started using DE. Much much much cheaper and as far as I'm concerned the advantages FAR outweigh the risks.

Sam  
(hope that was helpful)

#### E.3 HOW DO I USE D.E. IN FOOD STORAGE?

To use, you must mix thoroughly one cup of DE to every forty pounds of grain, grain products or legumes. You need to make certain that every kernel is coated so it is better to do the mixing in small batches where you can insure more even coating.

**WARNING:** Since DE is essentially a kind of dust, you need to take steps to keep it out of your lungs and eyes. Even whole wheat flour dust can cause lung irritation if you breath enough of it.

DE does not kill the insect eggs or pupae, but it will kill adults and larvae and any eggs or pupae that hatch into adults will die after coming into contact with it.

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V -- SHELF LIVES

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A. SHELF LIVES OF SOME COMMON STORAGE FOODS

From: Geri Guidetti <arkinst@concentric.net>  
Newsgroups: misc.survivalism  
[Contact info in V.A.Books]

...As far as general rules for shelf lives of common veggies and fruits is concerned, jarred foods keep at least 6 months longer than cans if stored in the dark as well as dry and cool. Glass is inert. Acid or acidified foods such as sauerkraut, apple sauce, pickled beets, tomatoes, tomato sauces, pineapple and citrus juices, etc. keep the least length of time in cans. They do interact eventually with the metal of the can. They will taste "tinny" and blacken as well. These are suggested by their mfrs. to be eaten within 18 months of the day packed--that's where the code comes in. Jars of the same products last at least 24 months from date packed. Non-acid foods in cans--corn, green beans, mixed veggies, mushrooms, potatoes, yams, asparagus, carrots, etc.-- will keep a minimum of 24 months. Beyond these dates, though the food will not have deteriorated beyond eating, there is a steady vitamin loss in percentage points each year for individual veggies and fruits. The percentage varies with the product. But they ARE still edible. The cooler/darker your storage conditions, the greater the shelf life as a rule and you can push these dates some.

Interestingly, the shelf life of evaporated milk varies with the fat content. From my book: Skimmed evap. milk, only 9 months. Lowfat, 12 months. Regular, 15 months. Sweetened condensed, 12 mo. This, Carnation says, has to do with the stability of the milk proteins and their expected performance in the recipes people use them for. They still have nutrition but will fail performance tests in cakes, etc. The skimmed and low fat versions will also darken faster.

For the group member asking about the longevity of canned meats: Meat, salmon, stews and tuna--24 months recommended shelf life. Again, you can extend that with no danger if unopened but with fewer intact nutrients.

B. DATING CODES USED BY SOME CANNERS AND PACKERS

From: Geri Guidetti <arkinst@concentric.net>  
Newsgroups: misc.survivalism  
[Contact info in V.A.Books]

Tammy Barette wrote:

> I was a little shocked to learn that MREs are expected to be  
>usable for only a 5-7 year period. I routinely keep store bought  
>canned goods for more than two years, regardless of their expiration  
>date. So far I have never encountered a bulging can or food which has  
>a funny odor, and I have never experienced food poisoning.

> Just how long will a canned meat product stay fresh? Vegetable product?

> (Today was a wonderful lesson in food shortages -- we're expecting >a whopppping 4" of snow tonight and the bread shelves are empty at the >stores in large areas of Ohio.)

I will do my best to answer. First, individual companies make up their own codes to be stamped on the tops of cans and jars. I finally got disgusted enough trying to decipher them when doing research for my book that I called a few big food corporations and asked "what's up?" with these coding systems. Carnation Foods was one and deciphered their evaporated milk stamps--example: 4145MC 202S. The only thing important to us lies in the first four digits. The 4 stands for 1994, the year the milk was packed. The 14 represents the 14th day of...the 5, the 5th month, May of the year. This can was packed May 14, 1994, well past their recommended shelf life. The rest of the letters and digits represent plant and lot numbers as I recall. Now let's make things more confusing: A can of store brand cranberry sauce is stamped NOV 98 MO 652. This firm stamps the pull date, or date after which they can't guarantee top quality. Much more direct for our purposes. A jar of mustard, another company: 696270 Packed June of 96 and should have a shelf life of at least 2 years if packed in a cool dark place. Remember this is a glass jar, not an acid-sensitive tin can. More on that in a minute. A jar of tomato sauce, not a can: OCT98 1003....etc. Bless them, too, an easily read code that suggests it's at top condition until Oct. of '98 if kept in good storage conditions.

In a nutshell, my observations have been that more and more mfrs. are beginning to use more user-friendly codes, but the funny business still persists for many. On such cans, like the evap. milk, read the can label carefully to locate a consumer hotline or customer service no. Call it and ask for a translation and then register your dissatisfaction with their coding system. Tell them you and your food storing friends won't be able to buy their products if you are to be kept in the dark concerning expiration dates, etc. They WILL listen. BTW, my discussions with Carnation disclosed that the grocery store, a large, reputable chain, had sold me evap. milk two years beyond the recommended storage date! Carnation called the store to tell them to pull it off the shelves and then sent me two coupons for free cans for the ones bought past date...

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VI -- RESOURCES

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[This FAQ does not tell me what I need to know!]

Please put the question to the rec.food.preserving, rec.food.cooking or misc.survivalism newsgroup. You could even resort to the tried and true method, a book.

The following is a list of books that I have found to have useful information. It is by no means an exhaustive list on the subject. If you have books you would like to suggest, please feel free to e-mail me with the particulars. If you can please include the same kind of

information about the book in question as you see below, particularly the ISBN #, if it has one.

A. BOOKS:

BUILD YOUR ARK! Book 1: Food Self-Sufficiency; Geri Guidetti; 1996; ISBN# 0-938928-01-5; Published by the author; The Ark Institute, P.O. Box 364, Monkton, MD 21111; E-mail to arkinst@concentric.net

COOKIN' WITH HOME STORAGE By Vicki Tate; 1993; ISBN# none; Published by the author; Address: 302 East 200 Nort, Manti, Utah, 84642; Tel # (801) 835-8283

HOME FOOD SYSTEMS Edited by Roger B. Yepsen, Jr.; 1981; ISBN# 0-87857-325-9; Rodale Press.

KEEPING FOOD FRESH Janet Bailey; 1985; ISBN# 0-385-27675-3; Doubleday & Co.

KEEPING THE HARVEST Chioffi and Mead; 1991; ISBN# 0-88266-650-9; Storey Communications.

MAKING FOOD STORAGE FUN, FAST & EASY LauraAnne J. Logar; 1993; No ISBN; Published by the author; Address: LauraAnne J. Logar, 17140 Oak Leaf Dr, Morgan Hill, Ca 95037-6621

MAKING THE BEST OF BASICS - FAMILY PREPAREDNESS HANDBOOK James T. Stevens; 1996; ISBN #1-882723-25-2; Gold Leaf Press  
<http://www.webcom.com/infinet/basics.html>

MARLENE'S MAGIC WITH FOOD STORAGE Marlene Petersen; 1991; No ISBN; Published by the author; Marlene's Magic, 4958 Alpine Circle Highland, Utah 84003 (801) 756-6423

NUTRIENT CONTENT OF THE U.S. FOOD SUPPLY, 1909-1988; 1992; Nutrient Education Division; Human Nutrition Information Service of the USDA.

NUTRITIVE VALUE OF AMERICAN FOODS; Catherine S. Adams; 1975; No ISBN; USDA Handbook No. 456

PUTTING FOOD BY; Greene, Hertzberg and Vaughn; 1982 (14th edition); ISBN# 0-525-93342-5; Penguin Group.

ROOT CELLARING (1994); Mike and Nancy Bubel; ISBN 0-88266-703-3.

WHOLE GRAINS; Sara Pitzer; 1981; ISBN #0-88266-251-1; Garden Way Books

B. PAMPHLETS:

Consumer Information Center, Department EE, Pueblo CO 81009. Ask for the Consumer Mailing List Catalog. Can order those nifty USDA pamphlets from this catalog.

Check your extension service office for pamphlets, which can usually be bought for a dollar or so. Especially important for high altitude canning, getting recipes specific for locale, even information on U-Pick sites and local farmers' markets.

Controlling Indianmeal Moths in Stored Shelled Corn and Soybeans  
Phil Harein and Bh. Subramanyam; FS-0996-A-GO Revised 1990  
Minnesota Extension Service, University of Minnesota

FOOD STOCKPILING FOR EMERGENCY SHELTERS. Food and Materials Division, Commodity Stabilization Service, USDA, April 1961]

Food Storage In The Home FN502  
Utah State University Cooperative Extension Service Bulletin

Frequently Asked Food Questions FN 250, 1993  
Utah State University Cooperative Extension Service Bulletin

Molds And Mycotoxins In Feeds; C.M. Christensen, C.J. Mirocha, R.A. Meronuck; FO-3538-C-GO 1988;  
Minnesota Extension Service, University of Minnesota

Molds In Grain Storage; Richard A. Meronuck  
FO-0564-C-GO Revised 1987  
Minnesota Extension Service, University of Minnesota

Nonfat Dry Milk FN142  
Utah State University Cooperative Extension Service Bulletin

Use of Oxygen Absorbers in Dry Pack Canning; Albert E. Purcell, Theodore C. Barber, John Hal Johnson; Benson Quality Assurance Laboratory Department of Food Science, Brigham Young University

C. MAGAZINES:

American Survival Guide  
P.O. Box 68033  
Anaheim, CA 92817-0833  
(714) 693-1866

Backwoods Home Magazine. Dave Duffy, publisher.  
P.O. Box 40  
Montague, CA 96064  
(916) 459-3500  
(800) 835-2418 (orders only)  
E-mail: backwood@snowcrest.net  
<http://www.snowcrest.net/backwood>

Countryside & Small Stock Journal  
N2601 Winter Sports Rd,  
Withee, Wisconsin 54498  
(800) 551-5691

Mother Earth News  
P.O. Box 56302  
Boulder, CO 80322-6302

(303) 678-0439

D. PHONE: (non-modem)

Your extension service--check your local university directory, especially if its a Land Grant College; look under Government Services, under Dept. of Agriculture. Master Preservers--similar to Master Gardeners or Master Composters.

E. ELECTRONIC:

E.1 INFORMATION SOURCES

[ftp ftp.ucdavis.edu pub/extension/4h-youth](ftp://ftp.ucdavis.edu/pub/extension/4h-youth) fp001.zip-fp008.zip  
Files are compressed, written in Word Perfect 5.1 or Post Script format. Files are eight lessons in food preservation.

<ftp://ftp.michvhf.com/pub/rec.food.baking/FAQ>  
The FAQ for the rec.food.baking news group. Good stuff.

<http://www.tiac.net/users/mcron/rff1.html>  
Website with the rec.food.preserving FAQ's on it.

<http://waltonfeed.com/self/default.htm>  
The Walton Feed information area on food production, preservation, storage, water storage and purification, nutrition, planning, culture and a great deal of other useful information. One area also has the labels showing contents, nutritional breakdowns and other information of most of the products produced and/or sold by Walton Feed.

E.2 SOFTWARE SOURCES

[I have not used any of these programs myself, but I'm listing them for those who might be interested - editor]

<http://waltonfeed.com/grain/calc.html>  
There are two Excel spreadsheets here that can also be imported into Lotus 123, Quattropro or Works For Windows. The first spreadsheet is a nutritional calculator showing the breakdown of 65 nutrients for 167 foods with more being importable. The second spread sheet is a yearly supply calculator.

<http://waltonfeed.com/self/plan.html>  
A nutritional calculator that allows you to enter your food supply and it gives you a daily nutritional printout. This is a smaller, less versatile version of the one from Revelar, but is less resource intensive and will run on a DOS only machine.

<http://www.revelar.com/fsp.html>  
A more extensive, versatile version of the above program, makes it much easier to modify for personal use. It also requires at least a 486, Windows and 8mb of Ram. A version for the Mac is available as well.

<http://beprepared.com> (click on free software area)  
Offered on the Emergency Essentials website. The first program is a food planner demo for creating shopping lists and planning recipes for any length of time. The second is a 72 hour preparedness program that will take you through various disasters and how to prepare for them.

## F. ORGANIZATIONS

### F.1 THE CHURCH OF JESUS CHRIST OF LATTER DAY SAINTS

[see metal cans section until I have the time to write this area]

## G. FOOD AND EQUIPMENT SUPPLIERS

### G.1 MAIL ORDERING STORAGE FOODS -- WHAT YOU SHOULD KNOW

When it comes to building a long term food storage program, sooner or later it is going to become necessary to seriously consider mail ordering at least a part of the foods you want to store. Even for those of us who try do as much as we can locally there are some things which are not going to be easily available in your area. Because of this I have included below a list of food and equipment suppliers where just about anything can be found.

Because many do find it necessary or desirable to purchase through mail order I am including a few points which should be considered before shelling out the cash.

1. Find out how much the shipping costs are going to be. Grains and legumes are relatively cheap, but weigh a lot when bought by the five or six gallon-bucket full. Because of this, shipping charges can sometimes as much as double the actual cost of the product by the time you get it to your door. Adding insult to injury is the new \$2.00 per bucket fee UPS is charging. Compare carefully each company's list price \*and\* their shipping charges, combined, when deciding who to order from. Saving up for a larger order, or trying to find someone to combine orders with might enable you to make a large enough order to get a price break on shipping. You could also take a vacation in the area of the company's location or swing through the area on the way back from one. If you choose to do this, be certain to call ahead and let them know so they'll have your order ready and waiting for you. The company in the next state may be slightly higher on the list price, but end up being much cheaper than having it shipped in from six states away.

2. Ask the supplier when your order is going to ship. Some suppliers are way behind in order filling and you could be waiting and waiting. Slowness in shipping is not necessarily a sign of bad business. Some suppliers may drag their feet, but others may be genuinely swamped by the volume of business they are receiving because they have a good product at a fair price.

3. How fresh is the product you are ordering? Freshness is what it's all about when it comes to storage foods. If a food has a five year shelf life in its container then you want as much of those five years to be on \*your\* shelf, not the supplier's.

4. Be very clear as to how the product you are ordering is packed.

Many suppliers offer identical foods packed in several different ways. Be certain the product number you are giving the salesperson is for the product packed in the manner in which you want it.

5. If you are ordering foods packed in a nitrogen flushed oxygen free container (with or without an oxygen absorber packet added) then ask about the laboratory test results that measure the oxygen content of the head gasses in the container. This is of great importance if you are counting on the extra storage life such packaging will give you. There are but a few companies such as Perma Pak, Sam Andy and Walton Feed that actually produce packaged storage foods and most dealers only distribute and retail their products. If the dealer can not produce the manufacturer's test data measuring the head gasses of the products they are selling then keep looking.

6. If you are purchasing wheat and intend to use it primarily for bread making then be sure to ask about its protein content. The best breads need at least 12% protein and the higher the better. Also take a close look at the weight of the grain. One company's five or six gallon bucket of wheat may not weigh the same as another's. The same applies to dehydrated foods such as fruits, vegetables, tvp, etc. Ask about the moisture content of bulk foods which are not already packaged for long term storage. 10% moisture is where you want to be for grains, legumes and most everything else.

7. What is the company's damage and return policy? If your carefully packed superpails and #10 cans get dented or cracked in shipping you'll need to have them replaced. Most mail order companies will require you to contact the shipper (such as UPS) for a claim number. The shipper may or may not require an inspection so don't destroy any packaging or containers until you know for sure.

Does anyone else know of anything else a person should look out for or ask about when mail ordering storage food?

## G.2 ADDRESSES OF SUPPLIERS

DISCLAIMER: The addresses listed below were either found by me or sent to me by the business owners or interested readers. I make \*NO\* representation as to their worthiness to do business with. Most of these merchants or manufacturers have been in their field for many years and will be around for many more and are honorable in their dealings. However, there are some businesses that spring up and then dissapear and with every update of this work there is at least one or two that I cannot locate from the previous update. The advent of the World Wide Web has only exacerbated this problem. In addition to the precautions mentioned in G.1 above you should take all of the usual precautions in mail or phone ordering.

I have accumulated the following list of names and addresses of various suppliers of one thing or another relating to food preservation and storage. They are roughly categorized by type:

STORAGE FOOD MANUFACTURERS: the actual producers or packagers of storage foods. Some also do retail sales of their products, but others

don't.

FOOD PRESERVATION DEALERS AND SUPPLIERS: these are businesses dealing with the aspects of food \*preservation\* as opposed to storage. Canning, meat curing, fermented milks, pickling, spices, soybean products, brewing, vintning, etc.

FOOD STORAGE AND PRESERVATION EQUIPMENT MANUFACTURERS: the actual manufacturers of equipment. Some will do retail sales and some do not.

DIATOMACEOUS EARTH MANUFACTURERS AND DEALERS: self-explanatory.

STORAGE FOOD RETAIL DEALERS: retail sales of all of the above.

Naturally, addresses, phone numbers, web sites, etc change over time so if you have more current information than I'm giving here, please be so kind as to let me know. Additionally, I'm always looking for new companies so if you have some that I don't have I'd like to see those too. Thanks - ed.

#### STORAGE FOODS MANUFACTURERS

##### ALLIANCE FOODS

P.O. Box 845  
Invercargill, New Zealand  
0064 3 2158850 voice  
0064 3 2159889 fax

A New Zealand producer of freeze dried foods.

##### ALPINEAIRE FOODS

Post Office Box 926  
Nevada City, Nevada 95959  
(800) 322-6325  
(916) 272-2624 fax  
<http://www.alpineairefoods.com/>  
E-mail: sales@alpineairefoods.com

Storage food manufacturer. Shelf stable foods with a long storage life. Many foods that require no cooking. Also backpacking meals.

##### FREEZE DRY FOODS, LIMITED

579 Speer Rd  
Oakville, Ontario L6K 2E4 Canada  
(905) 844-1471  
(905) 844-8140 fax  
<http://www.freeze-dry.com/>  
e-mail: info@freeze-dry.com

A Canadian freeze-dried foods manufacturer. Produces Hardee Camping Foods. List of dealers on site.

##### HARVEST FOODWORKS

445 HWY 29  
RR#1  
Toledo, Ontario K0E 1Y0, Canada

(800) 268-4268  
(613) 275-2218  
(613) 275-1359 (fax)  
<http://www.harvest.on.ca>  
e-mail: [thefolks@harvest.on.ca](mailto:thefolks@harvest.on.ca)

A Canadian producer of primarily vegetarian (some have meats) dehydrated and freeze dried foods. A links page gives location of dealers. Ingredients and nutrition information on site.

OREGON FREEZE DRY, INC (Mountain House)  
P.O. Box 1048  
Albany, OR 97321  
(800) 547-0244  
(541) 967-6527 fax  
(541) 926-6001 international  
<http://www.ofd.com/mh/index.html>  
E-mail: [mtnhouse@ofd.com](mailto:mtnhouse@ofd.com)

Manufacturer of Mountain House freeze dried foods in pouches and larger cans. Does not sell direct, but through distributors.

READY RESERVE FOODS  
Post Office Box 697  
Beaumont, California 92223  
(800) 453-2202

Over 100 different dry food products for long term storage.

SAM ANDY FOODS  
800 West Airport Frwy., Ste. #1100  
Irving, Texas 75062  
(214) 445-4144  
(800) 331-0358

Manufacturer of low-moisture, long storage life foods. equipment, supplies and information for survival and emergency preparedness. Publishes a periodic newsletter - call to request a free copy.

SOPAKCO  
P.O. Box 1129  
215 South Mullins St  
Mullins, South Carolina 29574  
(800) 776-8731  
(803) 464-0121  
(803) 464-2178 fax  
<http://www.sopakco.com>  
E-mail: [MLBailey@worldnet.att.net](mailto:MLBailey@worldnet.att.net)

Manufacturer of military MRE's, their civilian MRE equivalent brand \*Camp & Trail\* and humanitarian pouch meals. Some product info on site.

STAR FOOD PROCESSING, INC.  
3444 East Commerce Street  
San Antonio, Texas 78220  
(800) 882-MEAL

RETAIL SALES. Fully cooked heat & eat serving trays. Each tray contains 106 ounces of fully cooked, ready to eat products. Thirty minutes time required to prepare a meal from pantry to the table. This product is shelf stable and requires no refrigeration or freezing for storage. Normal shelf life is two years.

WALTON FEED, INC  
135 North 10th  
P.O. Box 307  
Montpelier, ID 83254  
(800) 269-8563  
<http://waltonfeed.com>

RETAIL SALES. Major manufacturer and supplier of storage foods. N2 packed dehydrated foods, grains/legumes bulk and N2 packed, oxygen absorbers. Free food storage planning software. Labels of most products available for viewing on site. Very informative web site.

WORNICK COMPANY, THE (fomerly Right Away Foods and Shelf Stable Foods)  
200 North First Street  
McAllen, TX 78501  
(800) 565-4147 (Mil-Spec orders)  
(210) 687-9401  
(210) 687-7028 fax  
<http://www.wornick.com>

Manufacturer of military MRE's, their civilian MRE equivalent brand \*Mil-Spec\* and humanitarian pouch meals. Good information on military and civilian MRE's on their site.

FOOD PRESERVATION DEALERS AND SUPPLIERS  
Canning, meat curing, food drying, spices,  
pickling, cultured milk products, soybean  
products, etc.

CON YEAGER SPICE COMPANY  
144 Magill Rd  
Zelienople, PA 16063  
(800) 222-2460  
(412) 452-6171  
<http://www.nauticom.net/w-pa/yeager.htm>  
e-mail: bkrever@fyi.net

Meat curing, smoking, herbs and spices. Bulk sales.

COOKBOOK SHOPPE, THE  
Vickie Tate  
302 East 200 North  
Manti, Utah 84642  
(801) 835-8283

Home Storage & Preparedness Books including Cooking With Home Storage.

CUMBERLAND GENERAL STORE

#1 Highway 68  
Crossville, TN 38555  
(800) 334-4640  
(615) 456-1211 fax

A good deal of food preservation and storage equipment with the emphasis on non-modern gear.

DOUBLE SPRINGS HOMEBREW SUPPLY  
4697 Double Springs Rd.  
Valley Springs, CA 95252  
(888) 499-2739  
(209) 754-4888  
<http://www.doublesprings.com/>  
e-mail: homebrew@GOLDRUSH.com

Home brewing and vintning supplies of all sorts. May have oxygen absorbers. Preservative chemicals. Many books, including vinegar making. Vinegar mothers. A lot of equipment.

GEM CULTURES  
30301 Sherwood Rd.  
Ft Bragg, CA 95437  
(707) 964-2922 (mornings are best time to call, Pacific time)

Fermented food starter cultures such as natto, tempeh, amazake, miso, shoyu, tamari, koji, miso, sourdough and other bread leavens (barm, etc.), fil mjolk, viili, and kefir grains. Also natural nigari (bitterns) and calcium sulfate (gypsum) as well as a form box for tofu making.

HOME CANNING SUPPLY & SPECIALTIES  
P. O. Box 1158  
(1815 LaBraya St.)  
Ramona, CA 92065  
(619) 788-0520 (phone)  
(619) 789-4745 (fax)  
(800) 354-4070 (orders only)

Home canning and food preservation supplies such as bulk pectin. They offer regular pectin, low-methoxyl pecting without preservatives, and low-meth pectin with preservatives.

KOCH SUPPLIES  
1411 West 29th St  
Kansas City, Missouri 64108  
(800) 456-5624  
(816) 753-2150  
(816) 561-3286 fax  
<http://www.kochsupplies.com>  
E-mail: koch@kochsupplies.com

Primarily wholesale dealer in meat curing, smoking and sausage making supplies.

LEHMAN'S HARDWARE  
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(330) 857-5757  
<http://lehmans.com>  
E-mail: [getinfo@lehmans.com](mailto:getinfo@lehmans.com)

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(also regional sites, addresses on web site)  
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E-mail: [info@berlinpackaging.com](mailto:info@berlinpackaging.com)

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(801) 571-9115

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(800) 241-1516

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UNITED STATES PLASTICS  
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(800) 537-9724  
(419) 228-5034 fax  
<http://www.usplastic.com>  
E-mail: usp@usplastics.com

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Twinsburg, OH 44087  
(800) 362-1000  
(216) 425-3900  
(216) 425-3333 fax

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E-mail jandj@arn.net

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E-mail: ecostore@webcom.com

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E-mail: orders@amerifree.com

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(918) 696-5999 fax  
<http://www.baproducts.com>  
E-mail: Byron@baproducts.com

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E-mail: basics@dnet.net

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e-mail: jseitz@gte.net

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Please direct comments, questions, contributions and criticisms to:  
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