PRUDENT FOOD STORAGE: Questions and Answers.

How do I store the foods that I've chosen?

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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 went into it. It cannot get any better than what originally went 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 that every article, book, and teacher concerned with putting food by gives the same advice: Date all food containers and rotate, Rotate, ROTATE.

Within reason, the key to prolonging the storage life of your edibles is the average temperature of the area in which they are stored. The lower the temperature the longer the shelf life. Keep in mind that the storage life of most foods is cut in half by every increase of 18 F (10 degrees celsius). If you've stored your food in a garage that has an average 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 that 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 that it trapped inside. If you can, there's no reason not to use both. All storage containers should be kept off of the floor and out of direct contact from exterior walls to reduce the chance 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 it. That energy has the effect of degrading the nutritional content and appearance of your food. Fat soluble vitamins, such as A and D 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 that they came in. This will protect them not only from light, but help to cushion them from shocks that might break the 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.

It is important to keep in mind when discussing the usefulness of various foodstuffs that there are *two* shelf lives to be considered. The first shelf life is that of the nutrient content of the food. This actually begins to degrade from the moment the food is harvested. There are three factors that dictate nutritional shelf life: The food's initial nutritional content, the storage conditions and the processing steps that the food underwent before it was placed into storage. Eventually the nutrition will dwindle away to nothing. At some point it will have to be decided that the remaining nutrition is not worth keeping the food any longer and it should be rotated out of storage. This is the reason for the "use by" dates on many foods and shelf lives in general.

The second shelf life to be considered is that of a food's absolute useful life or the point at which you just can't gag it down. This will almost always be far in excess of what the nutritive life will be. We've all heard of people eating many year old preserved foods such as jams, jellies, MRE's and the like. If you don't have anything to replace it with, it's not necessary to throw it out just because it's reached the end of its nutritive shelf life, but do 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.

I am including an appendix at the end of this FAQ with tables of shelf lives of some common storage foods. Eventually, I hope to include instructions for reading the dating codes used by whatever packers and canners I can find or that readers will send to me. This has always been a major problem for those of us who stock quantities of canned goods from the grocery store.

II -- THE TECHNIQUES OF FOOD STORAGE

A. GRAINS AND LEGUMES [NEED AN APPENDIX ABOUT GRAIN MILLS]

A.1 GRAIN VARIETIES

One of the most important decisions in planning your long term food storage is the kind of grains that 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 decisions made for them by the storage food retailer that put together the food package that 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 whatever additional foods as the planner found to be desirable. Back in the thirties (I believe this is when that plan first got its start) that 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 common food allergies is to 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 off wheat for a large part of their diet. This is a major reason to 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 that 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 and become unable to survive.

In his book, Making the Best of Basics, James Stevens mentions a study by Dr. Norman Wright, of the British Food Ministry, done after the Second World War in England and Europe found that people 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 it'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 grains 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 it is by far the most commonly consumed grain in the United States I've put wheat at the head of the list.

WHEAT: Wheat comes in a number of different varieties each with different characteristics that makes a particular one more suited for a given purpose than another one. 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, the hard varieties have more protein than the soft varieties.

The soft varieties have kernels that tend to be larger, plumper and softer in texture than the 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 that the hard white varieties make a better tasting whole wheat bread than the hard red.

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

AMARANTH: Amaranth is not a true cereal 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 it can be boiled and eaten as a cereal, used in soups, granolas, etc. 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 that it's found in is called "pot" or "hulled" barley and it has been subjected to the same milling process as pearled, but with few 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 it's low gluten content will not make a good loaf of yeast 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.

BUCKWHEAT: Buckwheat is another of those foods commonly considered to be a "grain", but that is not a true cereal. It is a close relative to the docks and sorrels. The "grain" itself is a dark, three cornered seed that resembles 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 that has 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: Corn is the most commonly grown grain 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, sweet 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 or flour, 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 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 that it makes a very good meal, but it's just a bit gritty for flour. Your mileage may vary.

Popcorn is one form of whole grain that is available to nearly everyone if they know where to look. Since it's so popular as a snackfood, particularly in movie theaters and events like fairs and ball games, even the smallest of towns will generally have at least one business that sells it in twenty five or fifty pound bags. Since it's meant to be eaten it's safe for food. In order to have it pop well it must have a moisture level of approximately 10% meaning that it's not likely to have to be dried before it can be put into storage.

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 vitamin A content of

yellow. 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, it should be kept in mind that much of the niacin content of corn is chemically bound up in a form that is not available for human nutrition unless it has been treated with an alkali. If grits, hominy or corn masa is 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 it is little known as a food in the U.S, mostly being used as a 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 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 serving 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 this country as a bland breakfast food. They are seldom found as a whole grain, usually being sold processed in one form or another. Much like barley, oats are a difficult grain to get the hulls off of. Besides being eaten for breakfast, where they can be made very flavorful with a little creative thought, oats make an excellent thickener of soups and stews and as a filler of in meat loafs and casseroles. Probably the second most common use for oats in this country are in cookies and granolas.

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

Whole oats: This is with the hulls still on. They are sold in seed stores and sometimes straight from the farmer that 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.

Oat groats: They 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: These are oat groats that 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 and many supermarkets.

Rolled oats: These are also commonly called "old fashioned" or

"thick cut" 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 to suit than do the quick cooking oats, but they retain more flavor and nutrition. This is what most people will call to mind when oatmeal is discussed.

Quick cooking rolled oats: These are just steamed oat groats that are rolled thinner than the regular or old fashioned kind 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.

RICES: Rice is the single most commonly consumed food grain in the world and 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 the kernel grains; short, medium and long. Each of those can be processed to one extent or another and be found as brown, white, parboiled or converted and instant rices. Below is a short discussion of these various types and their relative differences.

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 that of long grain rice.

Medium grain rice: Medium grain rice is not very common in this country. It has flavor like that of short grain rice, but with a texture more of 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.

The processing that the rice receives further classifies it and the below is a list of them.

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. Under that kind of packaging, if properly done, the storage life of brown rice can be extended for years.

I am experimenting with the use of oxygen absorption packets in air tight plastic bottles to determine if brown rice's shelf life can be extended in that manner, but it will be at least a year before I can determine any results. If you are not using special storage or packaging for your brown rice then it is important that you rotate your storage rice regularly to avoid spoilage.

Converted rice: Converted rice starts as brown rice that undergoes a process that soaks and steams it until it is partially cooked. It is then 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 to replace what was removed.

QUINOA: Quinoa is yet another of the "grains" that is not a true cereal. It's botanical name is Chenopodium quinoa (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. The sources that I've found on this exotic grain indicates that it 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.

To be honest, I really know very little else about this grain, having only heard of it less than a year ago. If anyone out there has more detailed information about this new (to me anyway) foodstuff, I'd like to hear from you.

RYE: Rye is a well known bread grain in this country, though not as popular as the various wheat breads. It has dark brown kernels that are longer and thinner than wheat, but it has 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 that is made unrefined rye flour and molasses is the blackest, densest form. It makes for excellent variety in the diet.

What I am about to say in the following is for those who may be interested in buying field run rye straight from the producer or distributor before it has been cleaned. If you purchase your rye from a foodstore *after* it has been cleaned, it is not much of a concern.

There is a fungal infection of grain that is called "ergot". It is attracted to rye more so than other grains, particularly if the growing conditions were damp where the rye 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.

The fungal disease affects only the flowering parts of many members of the grass family. The fungus bodies are hard, spur like, purplish-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 funguses. 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.

SORGHUM: Sorghum is probably more widely known in this country for the syrup that is 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. There are varieties called "yellow endosperm sorghum" that have a better taste. Sorghum is a major feed grain in the southwestern part of the country and that 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 forehead of Star Trek script writers, tribbles notwithstanding. 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, and oval shaped larger than wheat kernels and plumper than rye kernels. 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 that either wheat or rye is. Although it is the youngest of the grains, it's been around for some years now. For reasons that 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 very great deal of money on various forms of preserved meats, a food storage program that does not include a quantity of legumes is simply incomplete. There are few

non-animal foods that contain the amount of protein that is to be found in dried beans, peas, and lentils. The varieties commonly available in this country have protein contents that range 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 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 South. 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, though 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 probably best known to us 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 in color and taste 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 with either rice or cornbread.

CHICKPEA: Also known as the garbanzo bean, it tends to be a creamy or tan color, rather lumpily 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. They 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 beans and have a distinctive flavor. They are much used in Far Eastern cuisine from Indian to Chinese.

LIMA BEANS: In the South, 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: Although many folks do not know it, the peanut 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 the confusion about their classification and growth, they are certainly not unfamiliar to U.S. eaters. Peanuts have a good protein percentage and even more fat. They are one of the two legume species commonly grown for oilseed in this country, they 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. It is stereotypically bean shaped with 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 cuisine and industrial uses of the soybean. It is by far the highest protein legume 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 of the global supply of these beans, we actually consume virtually none of them directly. Most of them go into cattle feed and for industrial uses. What does get eaten directly has usually been processed in some form or fashion with soybean products ranging 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 very well served to begin to learn how to process and prepare them *now* when you're not under pressure to produce. That way mistakes can be thrown out rather than having to be eaten regardless.

A.3 TYPES OF AVAILABILITY OF GRAINS AND LEGUMES

Grains of all types and legumes 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 an 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 it was grown and harvested under.

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 that the product receives, the higher the price for it is likely to be. If you don't mind doing a little cleaning then field run grain is the way to go if you need to be frugal with your cash.

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, fumigants, fungicides or insecticides that are unsafe for human consumption and other things of equal undesireability. They will have been checked at least several times by the Federal and state agriculture dept's and probably by the major foods dealers as well to insure the quality of the product.

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.

If you are buying your grains and legumes from someplace other than a foodstore then you need to know the history of what it is that 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 that it may have been infected with molds that would make it unsafe for human

consumption. Field run from storage and any grade of grain not specifically advertised for human consumption may have had fumigants, fungicides or insecticides added to it while it was in the bin. In addition, there may have been mold growth there as well. It is important to know what it has been treated with before you buy it.

Sometimes grain in the form of animal feed or seed grain/legumes is available. Keep in mind that animal feeds may have a higher contaminant level than what is permissible for human consumption. Under certain circumstances, the government 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 content of five times what is permissible for use in human foodstuffs. They 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 if it has been tested for mold or mycotoxin content. This is especially the case if you are buying field run corn, rye, soybeans and 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.

A.3.1 MOISTURE CONTENT

The moisture content of the grain that you want to purchase (or grow) has a major impact on how long you will be able to store it for and have it remain nutritious and edible. Some of the information that 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 that you buy or grow may have thousands of fungi spores and bacteria on them. 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%.

Thus, if you have grain that 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 are like me and do not have a clue as to what the moisture level of your grain is here is a method to roughly determine it.

Take 20 ounces of the grain or legumes in question from the middle

of the bag or container that you've got them in. This needs to be an actual weighed twenty ounces and not estimated. Spread the grain in a large baking dish making sure that 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 readsorb moisture, the oven will do. Once cool, reweigh the grain. A one ounce loss in weight indicates that 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 that 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 that you've bought isn't clean enough to suit you, you can do it yourself.

The fastest and easiest method is "fanning". 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 they can be further cleaned by running through a screen or sieve. These should be made with holes just big enough to pass an average sized grain of what it is that you're cleaning. Obviously, the size of the holes will necessarily vary depending upon the kernel size of what it is that you are cleaning.

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

A.4.1 Moisture and Desiccants

The key to storing grains (and legumes) for the long term is dry, dry, dry. Available oxygen and storage temperature also play roles, but it is moisture content that will determine whether you get usable food out in five years or not.

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

Ideally, the clean grains and legumes that you have in 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 grains aren't sufficiently low in moisture content then you'll need to reduce the water that they contain. Wheat has been taken out of 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 that 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. I typically wait until January here in Florida. 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. About three days of cool, constant air flow and low humidity ought to dry things out a bit.

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 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 that it saturated in storage.

I use silica gel for practically everything. Keep in mind that it is not edible and you don't want it getting mixed into your food. 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. 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.

Once you've dealt with the moisture problem, then you can decide whether you want to displace and/or absorb the oxygen out of your storage container. There are three common methods of doing this. The first two use relatively inert gasses, carbon dioxide and nitrogen, to displace the oxygen. The third uses an oxygen-absorbing chemical to remove very nearly all of the gas from the container's atmosphere. Some folks even go so far as to use inert gas displacement and oxygen absorption together.

A.4.2 Dry Ice

Now go ahead and pack your buckets. If you're using dry ice be sure to wipe off any accumulated frost and wrap the ice in a paper towel or something similar so that 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 CO2 should fill the bottom of the bucket, displacing the warmer, lighter atmosphere and pushing it out the top of the container. About four ounces of dry ice 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.

A.4.3 Compressed CO2 or Nitrogen

Using compressed gasses calls for a slightly different technique. Bring everything inside just like above and let it dry out. You'll need some plastic bags that are a bit larger in internal volume than the bucket. Additionally, you'll need a tank of the compressed gas that you've chosen, a hose to attach to it and a length of straight copper tubing just longer than the bucket to attach to the end of the hose. Last you'll need a pack of matches, a cigarette or similar.

Line the interior of the container with the plastic bag. Fill the bucket with grain, shaking to get it as full as possible. You don't want any pockets left between the bag and the container. Once you have gotten it full to just short of not being able to put on the lid, gather the top of the bag together. Take the hose with the copper tubing on the end and insert it to the bottom taking care not to tear the bag. Close the top of the bag around it. Turn on the valve and begin to fill the bag with gas. You want to fill it *slowly* so that you can minimize turbulence and mixing as much as you can. I generally will just crack the valve until I can hear it begin to hiss out and then put my hand over the end of the probe to feel how fast it's coming. It'll take a little while to fill each bucket -- about five to ten minutes per. Just as with the dry ice above, the idea here is for the cool gas to displace the warmer atmosphere from the container. The bag 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 figure the oxygen has been displaced, I let it run for a minute longer and remove the probe. 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.

I want to insert a caution here about packing foods with nitrogen or CO2. Either gas will do very well for oxygen displacement inside the bucket, but the technique that you use here is very important. Dry ice is extremely cold and if there is much moisture in the air that is trapped in the container with it, and your food, then it will condense. If there's enough of it, it's going to cause you problems. If you are going to put the dry ice in the bucket, you'll really want to do this on a day when the humidity is very low. The temperature of the gas coming out of the tank has concerned me, also, since it is rather cold. I like to use as long a hose as I can get to allow the gas to expand and warm as much as possible before it goes into the bucket. An idea that I've had, but have not yet tried is to hook the hose to a copper coil (a la a moonshine still) and have the gas go through that to warm it before putting it into the container. The next time we do any experimentation with this stuff I think I will. Whether you use dry ice or compressed gas, I would add about four ounces of desiccant to a five gallon bucket of stored food.

A.4.4 Oxygen Absorption Packets

If all of this messing about with gasses sounds like too much trouble, you can try using the oxygen absorption packets that have come onto the market in the last ten years or so. The only brand that I am aware of is the Mitsubishi Ageless 300 (mine are the 300E type). Each unexposed tablet is supposed to absorb 300 ml of oxygen per packet, though the paper in the specific equipment section seems to suggest that they'll do much better than that. As a general rule of thumb, one packet per gallon of *volume* in the storage container is what is called for. Follow the directions concerning moisture and when things are dry enough then fill the containers, place one packet per gallon of container volume inside and seal it up. Be certain that you do, in fact, have an air tight seal or you'll just deplete your packets over time to no positive effect.

For those belt and suspender types who like to have as much certainty as they can get, you can use either of the above atmospheric displacement techniques and an O2 absorber packet together to eliminate all of the oxygen that you can.

Once I started using the method above with the drying out of the containers and foodstuffs, the *careful* atmospheric displacement with inert gasses and the desiccant, I've never lost a container of storage goods due to mold or mildew. If you've done a proper job with the gasses, you'll kill any insects or insect eggs as well. After that, it's just age and average storage temperatures that degrade the nutritional contents of the foods and you should have a rotation plan to deal with that before it becomes a problem. Take care in your

technique, use only quality goods and you'll have food that you can eat when you open those containers.

B. DRY MILK

1 SELECTING AND BUYING DRY MILKS

B.1.1 TYPES OF DRY MILKS

NONFAT DRY MILK. This is pasteurized skim milk that has been 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 that you can drink or cook with just like fresh milk, with a considerable flavor difference. I don't care for the stuff to drink, but instead add the powder to baked goods, smoothies, hot cereals, casseroles and meat loaf as a nutrition booster.

FLAVORED NONFAT DRY MILK. 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.

DRY 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.

DRY 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.1.2 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 came 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 does 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.

(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.2.1 STORING OF DRY MILKS

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

The area that your dry milk is stored in should be kept as cool as is 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 that is 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 dryer it can be kept, the better it will keep. Oxygen also speeds decomposition. Dried milk canned with nitrogen or carbon dioxide to replace air (which contains oxygen) will keep longer than dried 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 well enough for the relatively short nutritive shelf life that this product has.

The method I use is to pour the powder into clean, dry one liter soda bottles. I use these rather than the two liter bottles because I

don't use a lot of dry milk at any one time and the last half of the bottle would get old before I used it. I purchase seltzer water this way so the bottles start clean. Once the bottles are filled I then add a small desiccant pack and seal. The bottles are dated and stored in the ubiquitous cool, dark place. We do not reuse the bottles. Once the milk they contain has been used they are recycled. I haven't tried this yet, but you could also add an O2 absorption packet to each bottle. This might be too expensive to do with the one liter bottles, but should be relatively inexpensive for the two liter variety. They also would help to keep the milk from going stale before it got used.

Another method I've seen used it to remove the paper envelopes of milk powder from the cardboard box that they came 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.

Glass canning jars could also be used for the repackaging. While they must be guarded against breakage they offer the advantage of not holding odors thus allowing them to be reused after suitable cleaning. Since they are as transparent as the soda bottles the contents must be protected against light. If desiccant and/or O2 packets are to be used they will have to be placed inside the jars themselves.

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 give it a fresher flavor.

B.2.2 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.

B.2.3 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]

We do make other products, and they pretty much fall into the categories of dry milk, baking products, chocolate confectionery items, and salad kits. For long-term storage, our Premium Cocoa (a blend of natural and Dutched cocoa for baking) would be suitable. The shelf life on the cocoa is indefinite at room temperature. We also make a Cultured Buttermilk Blend. This is a dry buttermilk which replaces liquid buttermilk in all cooking and baking. Unopened, the Buttermilk Blend stays fresh indefinitely. Once opened, we recommend refrigeration, then as long as it is powdery, versus solid, it is fine to use, which can be up to several years. Our other products have more limited shelf lives, so they are probably not as suitable. If you would like to contact me again with your zip code, I can provide you with information on where you may purchase the Premium Cocoa and/or Buttermilk Blend in your area. Also, if you would like to provide me with your address, too, we have a free sample of the Buttermilk Blend available at this time, so you can try it before buying.

I hope I have answered all your questions. Please feel free to let me know if I can be of any further assistance, either by e-mail or on our toll-free number, which is 1-800-373-7226. Have a nice day.

C. CANNED GOODS (METAL CANS AND GLASS JARS)

1. LIQUID MILK

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:

C.1.1 CANNED MILKS. These are commonly called UHT milks (Ultra

High Temperature) for the packaging technique used to put them up. It comes in the same varieties fresh liquid milks come in: whole, 2%, 1% and skim. It has vitamin D added. For reasons I have not yet discovered, the lesser fat content milks do not seem to keep for as long and their "use by" dates are shorter term than the whole milk. 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. The dates on the label seem to vary. I buy the whole milk and the dates are usually for three months, but I've found them for as much six months. The milk is still usable past their dates, but the flavor soon begins to go stale. I am told by a friend who lived in Germany not long after this kind of canned milk began to come on the market over there they were dated for a year.

With only a three to 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 ever seen is Parmalat. It's a lot of bother, but to me it's worth it to have whole, fluid milk.

C.1.2 EVAPORATED. This milk is made from fresh, unpasteurized whole milk. The process removes 60% of the water; the concentrate is heated, homogenized, and 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.

C.1.3 SWEETENED CONDENSED. This milk goes through much less processing than evaporated milk. It starts with pasteurized milk that has been 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 it should be consumed by. Sweetened, condensed milk may thicken and darken as it ages, but it can still be used.

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.

2. CORROSION PREVENTION OF CANNED GOODS

Some areas of the country 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 waxing the outside of the cans. I've seen this used on many boats here in Florida, especially when loading for a long trip. There are two methods that can be used to do this:

C.2.1 PARAFFIN METHOD: Using a double boiler, paraffin is melted and brushed on the clean, unrusted 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.

C.2.2 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.

D. SUGAR, HONEY AND OTHER SWEETENERS

Sugar 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; maltose is one of the sugars in malted grains; pimentose is 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 some table sugar may still be made from sugar beets. Modern table sugar is now so highly refined as to be 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 long lives of dry sugars. Honey, 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.1.1 BUYING AND STORING GRANULATED, POWDERED, BROWN AND RAW SUGARS

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

GRANULATED SUGAR. 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.

POWDERED SUGAR and CONFECTIONER'S SUGAR. Both names refer to the same kind of sugar, that is white granulated sugar that has been 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). 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 the least amount of 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 SUGAR. In the United States brown sugar is basically just refined white sugar that has had a bit of molasses 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.

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, NATURAL or TURBINADO SUGAR. In recent years, sugar refiners have realized that there is a market for less refined forms of cane sugar here in the U.S. 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 this country 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.

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 raw sugar you might want to consider using some desiccant in the storage container if your local climate is damp. Since brown sugars 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.

D.2.1 SELECTING AND BUYING HONEY

Honey is probably the oldest sweetener known to man, predating 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 gathered nectar. This means that a smaller amount of honey can give the same amount of sweetening as sugar. Those 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 sugar has virtually none. It 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. Raw honey is generally considered to be 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 it 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 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 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.

CRYSTALLIZED or SPUN: This honey has had some of its moisture content removed to make a creamy, spread. It is the most processed form of 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 that you know you can trust. You should buy and store honey labeled U.S. GRADE A

or U.S. FANCY if buying in retail outlets. However, be aware that 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 that 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. However, 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 HONEY STORAGE

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.

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 then don't keep them near petroleum products (including gasoline engines), chemicals or any other odor-producing products.

D.2.3 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

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D.2.4 Q: My can of honey is bulging. Is it safe to use?

A: Honey can react 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.3.1 MOLASSES, CANE, SORGHUM AND TABLE SYRUPS.

Molasses and cane syrup are not precisely the same thing. Molasses is a by product of sugar refining and cane syrup is simply cane juice that has been boiled down to a syrup, much like maple syrup is produced. Non-southerners may know it better as "unsulphured molasses" even if that is not completely correct. Sorghum syrup is produced in the same manner, but sorghum cane rather than sugar cane is used. Sorghum tends to have a thinner, slightly sourer taste than cane syrup. All of these syrups tend to be dark with a rich, heavy flavor. There are many "table syrups" sold in supermarkets, but close examination of the ingredient lists will reveal mixtures of cane syrup, cane sugar syrup and corn syrup. They tend to have a much less pronounced flavor.

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 can be reliquified using the same method as with honey.

D.4.1 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 syrups (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 a poor storer compared to the other common sweeteners and because of this they often have a "best if sold 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 then throw the syrup out. You should always be certain to wipe off any drips from the bottle with every use.

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

D.5.1 MAPLE SYRUP

Maple syrup is probably the only sweetener that has developed a cult-like following. 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 it does, 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 that they are composed of. The fats and oils that are available to us for culinary purposes are actually mixtures of differing fatty acids so for practical purposes we'll say that saturated fats are solid at room temperature (70 F) and unsaturated fats that 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 they go rancid rather quickly. It's an area I am devoting research time to, but I have not yet come up with a good way to extend storage life for any great length of time.

There are some general rules you can follow to get the most life out of your stored cooking oil.

#1- Although darker colored oils have more flavor than paler ones, they don't last as long in storage. Therefore, for longer shelf life, buy paler colored oils.

#2- Heat, light and exposure to oxygen are the greatest factors in rancidity of cooking oils. If you can, refrigerate your stored oils. If possible, buy your oils in dark, opaque, airtight containers containers. Cooking oils should be stored in a cool, dark area.

#3- Unless they have been specially treated or packaged cooking oils have a shelf life of about one year, with a few specialized oils having a shorter life. 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 of oil to the air after you've opened the container.

It seems to me that buying oil in large containers and then repackaging it into smaller, opaque, perhaps more airtight containers would be a good thing to do. I haven't found any data on this yet so I do not know if it would actually accomplish any useful extension of storage life or not. If anyone reading this should happen to have any good data on this, I'd surely like to see it.

Additionally, I'm also looking for information about the usefulness of possibly adding anti-oxidants, to slow down the oxidative rate such as butylated hydroxyansiole (BHA), butylated hydroxytoleune (BHT), propyl gallate or vitamin E.

I hope to be able to significantly expand this area in the next version of this FAQ.

Y. COOKING STAPLES [Obviously, this section is going to be fleshed out]

BAKING POWDER. This powder is a combination of an acid, an alkali, and a starch that keeps 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.

SALT. Storage life for salt is indefinite. So long as you keep it dry and 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 it 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 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 in 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 might be very noticeable. If you are storing salt for this purpose, you should be sure to choose plain pickling salt, or other food grade pure 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.

Kosher Salt: I'm not precisely sure what makes kosher salt different from canning salt. I'm presuming that it must have been processed in a particular manner in accordance with the kosher dietary laws of the Jewish religion because it is used in preparation of kosher foods. It is generally larger in grain size than table or canning salt and may have even been rolled to produce "flaked" kosher salt. Grain size can vary from manufacturer to manufacturer.

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 has been purified enough to use in food. It's not very 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 that the churn sits in. It's also sometimes used in icing down beer kegs. I don't know if it is considered food grade or not. If anyone does know, for certain, please drop me a line.

Solar Salt: This is also sometimes confusingly called "sea salt". It is not, however, the same thing as the sea salt found in foodstores. 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 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 far enough south to 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.

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

Z. INFANT FORMULA

Since most folks into preparedness of one sort or another are planning for families, real or to be, 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.

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.

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 for 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.

III -- SPOILAGE

A -- Insect Infestations

A.1 Pests of Stored Dry Grains and Legumes.

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 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 that are clean and have a high volume of turnover of their products. This will mean that the products that you purchase from them will be unlikely to have bugs in them.

When you buy foodstuffs such as whole grains, flours, meals, pastas, legumes, bird seed, and dry pet foods examine them closely to be sure that they are insect free. Check for any packaging or "use by" dates to insure that they are fresh. Don't shake the package since most adult insects will be found in the top couple of inches the product and shaking the package will serve to 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 that they cannot be invaded after you have brought them 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.

Keep in mind that 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 in spite of buying fresh products and using careful packaging techniques that 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 that 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 that the food *containers* are stored upon 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 that are already in your stored foods.

Spray the shelf surface with 0.5% chlorpyrifos (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 usable 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 that they escaped from the packages that they were infesting and did not get cleaned up. There may be more packages infested than were originally realized. There may be hiding places in the storage area that needs 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 toadstools. 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 plant, called mycelium. The stalk of a mold plant 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 that 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. The 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 that are 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.

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 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
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 that 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 that 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 that 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, they can 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 with many other varieties of molds and their respective mycotoxins have been discovered. 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 is not so lucky. Still, it is good to have something of an understanding of what one should do to prevent mold growth in ones 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 that I am aware of in the United States from aflatoxicity, though other countries have not been so fortunate. What make 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 eat them 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 in soybeans, they must have a moisture content of that level. If you are storing raw peanuts, in the shell or shelled, you want to get the moisture content to less than 8% The recommended moisture content for all 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.) Obviously, if you are going to store raw peanuts (as opposed to roasted or peanut butter), the moisture level will need to be dropped even more. 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 that 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 be able to grow and thus spoil your foods, bacteria need moisture, some as little as a 20% 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 their 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.

In wet pack canned goods (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 that you've put by. In both home canned and commercially canned goods, IF THE CAN IS BULGING, LEAKING, SMELLS BAD WHEN YOU OPEN IT, SPEWS LIQUID WHEN OPENED THEN THROW IT OUT!

C.1 Botulism

C. botulinum is one of the oldest types of life forms found on the planet. Like the gangrene bacteria, it is an anaerobic organism meaning that 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 that 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. Only a pressure canner can reach the necessary temperature.

It's not the bacteria or its spores that are directly deadly, but the toxin that 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 that 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 that pH is not eternal in foods and that 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 that 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 largely are not 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 the next version of this FAQ. I've got so much data that I haven't yet boiled it down to what I want to put in.

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 that 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 that 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.

1. PLASTIC CONTAINERS

B.1.1 [What makes a bucket or plastic bag "food grade"? And where can I find them?]

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.

If it is stipulated that it is new, clean and unused then it is my understanding that any container made of high density polyethylene (HDPE - with a #2 inside the recycling triangle) is safe for dry foodstuffs. Anybody out there with factual information yea or nay?

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!

B.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

---

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.--

B.1.3 [OK, I've got some used food grade containers, but they're pickle buckets. How do I get the smell out?]

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. Good luck!

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2. METAL CANS

The metal cans used by the canning industry 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 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" is 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.

I know that the church of the Latter Day Saints (the Mormons) have gone over largely to metal canning for their food storage programs. If any reader out there has experience with their program and/or their literature that they'd like to share I'd be happy to put it into this FAQ.

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

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 that the

jars came in are well designed to cushion them from shocks. They also have 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.

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 of us, gardening is a pleasure (passion, obsession, addiction) and we have to have something to do with the food that we've grown! There's also the fact that for many, you simply cannot buy the quality of the food that 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, in particular parts 1-canning; 4-specific equipment questions; 5-spoilage (IMPORTANT!); 6-caveats, troubleshooting and sources.

B -- CO2 AND NITROGEN

I've gotten the nitrogen and the CO2 gas that I've used from a welding supply store. Dry ice can be had from ordinary water ice suppliers, some grocery stores and occasionally ice cream stores.

Does anyone out there have other sources that they have used for CO2 and nitrogen that they used for food storage purposes? Is there any reason that gas from a welding supply source shouldn't be used?

C -- OXYGEN ABSORBERS

I don't know exactly when they first showed up on the market for use by private individuals, but a relatively recent tool for long term food storage are oxygen absorption packets. The packets, called 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. 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 that they were even more effective than their rated absorption capacity of 300 milliliters of oxygen (O2 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%.

Even though they apparently will absorb a great deal more than the 300 ml of O2 that they are rated for, the following instructions for use are based on their listed rating. So, when using the Mistubishi 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 that 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.

If anyone out there knows of more precise instructions for the use of these O2 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 that I've found. It is from it that I derived the instructions I gave above.

The following is the verbatim text of the conclusions section of the Brigham Young study. See V.B Pamphlets for complete cite 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 e, 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

[PUT THE TITLE OF THE STUDY IN THE SOURCES APPENDIX]

D -- DESICCANTS

C.1.1 [Many of the food storage programs that I've read call for the use of desiccants. What is a desiccant?]

A desiccant is a substance with very hygroscopic (absorbs moisture from the air) properties. There's any number of different chemicals that meets that 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 generally found in the form of small white crystals looking much like granulated white 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 that 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 that 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 that 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. I generally do mine in one pound batches at full power for about five minutes. I then 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.

Keep in mind that silica gel is not edible so when you use it, you need to be certain that it does not spill or leak into your food. I generally use a double layer of coffee filter paper to seal the container that I've put it in. The paper is very permeable to moisture so the gel can do its absorbing, but it's tight enough to not allow the crystals out.

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 they may be a little over 10% moisture 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 two ounces 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.

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.

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 Filipivich <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.

E -- 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. 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.

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. 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.

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. An appendix with the names and addresses of some DE suppliers may be found at the end of this FAQ.

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

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)

V -- Other Sources (besides this FAQ)

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

Please put the question to the misc.survivalism newsgroup. You can also post to the rec.food.preserving 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 that 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: [I've got more that I haven't listed yet. Next version]

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

Marlene's Magic With Food Storage; Marlene Petersen; 1991; No ISBN; Published by the author; Marlene's Magic, P.O.Box 802, American Fork, UT 84003

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: [Same here. More that will be in the next version]

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:

Backwoods Home Magazine. Dave Duffy, publisher.
1257 Siskiyou Blvd., #213 Ashland, OR, 97520
(Occasional articles on food storage)

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:

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.

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VI -- APPENDIXES

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A. SHELF LIVES OF SOME COMMON STORAGE FOODS

I've got some info for this area and I'll be putting it in the next update of this FAQ.

B. DATING CODES USED BY SOME CANNERS AND PACKERS

OK folks, I don't have the first dating code used for canned foods so if we're going to have anything in this section I'll need some submissions.

C. SOURCES OF DIATOMACEOUS EARTH

All Gone! Phone: 800-373-3423; E-mail allgone1@vero.com

Diatect Corporation c/o Gordon Dill 410 E. 48th St Holland, MI 49423
Address taken from HOME FOOD SYSTEMS, by Rodale Press

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