

GRAINS AND LEGUMES

ABOUT GLUTEN:

As you read through the grain descriptions below you will come across frequent mention of “gluten”. Gluten is a combination of proteins found in some grains which enables the dough made from them to rise by trapping the gases produced by yeast fermentation or chemical reaction of baking powder or soda. The amount of these proteins varies depending on the species of grain and varieties within a species. Some grains such as rice have virtually no gluten at all and will not produce a raised loaf by itself while others like hard winter wheat have a great deal and make excellent raised bread. As a general rule yeast raised breads need a fair amount of gluten to attain good dough volumes while non-yeast raised breads may need little or none at all. Whether gluten content is of importance to you will depend upon the end uses you intend for your grain. Some of the common and relatively uncommon types of grains are listed below:

AMARANTH:

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

NOTE: Like some other edible seeds, raw amaranth contains biological factors that can inhibit proper absorption of some nutrients. For this reason, amaranth seeds or flour should always be cooked before consumption, whether for human food or animal feed.

BARLEY:

Barley is thought by some to be the first grain intentionally cultivated by man. It has short, stubby kernels with a hull that is difficult to remove. Excluding barley intended for malting or animal feed, this grain is generally consumed directly by humans in two forms. Most common is the white, highly processed pearl barley with much of its bran and germ milled off along with its hull. It is the least

nutritious form of barley. The second offering is called pot or hulled barley and it has been subjected to the same milling process as pearled, but with fewer trips through the polisher. Because of this, it retains more of the nutritious germ and bran, but does not keep as well as the more refined product without special packaging. Unless you are prepared to try to get the hulls off, I don't recommend buying unhulled barley. Although it can be milled into flour, barley's low gluten content will not make a good loaf of raised bread. It can be combined with other flours that do have sufficient gluten to make leavened bread or used in flat breads. Barley flour and flakes have a light nutty flavor that is enhanced by toasting. Whole barley is commonly used to add thickness to soups and stews. Recently, a hull-less form has become available on the market through a few suppliers. This is whole grain barley with all of its bran and germ intact and should have the most nutrients of any form of this grain available. I don't know yet how suitable it is for long term storage.

BUCKWHEAT:

Buckwheat is another of those seeds commonly considered to be a grain, but which is not a true cereal. It is, in fact, a close relative to the docks and sorrels. The "grain" itself is a dark, three-cornered seed resembling a tiny beechnut. It has a hard, fibrous hull requiring a special buckwheat huller to remove. Here in the U.S., buckwheat 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 much more strongly flavored than lighter flour, but because of the high fiber and tannin content of its hull, which can interfere with nutrient absorption, it is not necessarily more nutritious. Buckwheat is one of those foods with no middle ground in people's opinions — they either love it or they hate it. Like amaranth, it's high in lysine, an amino acid commonly lacking in the true cereal grains.

CORN (maize):

Corn is the largest grain crop in the U.S., but is mostly consumed indirectly as animal feed or even industrial feedstock rather than directly as food. As one of the Three Sisters (maize, squash and beans) corn was the staple grain of nearly all of the indigenous peoples of the American continents before the advent of European colonization. This American grain has an amazing variety of forms. Major classes are the flint, dent, flour, and popcorns. To a certain extent, they're all interchangeable for milling into meal (sometimes known as polenta meal) or flour (very finely ground corn, not cornstarch). The varieties

intended to be eaten as sweet corn (fresh green corn) are high in sugar content so do not dry or store well relative to the other corns but instead are usually preserved as a vegetable. There are a number of lesser corn varieties with specialized uses that do not lend themselves to direct food use, but these are seldom found in the open market. As a general rule of thumb, the flint varieties make better meal as they have a grittier texture than most other corns. If meal, hominy and hominy grits (commonly called just "grits") are what you are interested in then use the flint type if you can find a source. If you intend to make corn masa for tortillas and tamales, then the flour corns are what you want, but these are fairly uncommon on the commercial market so the dent corns are next best. Yellow dent seems to be the most commonly available and will work for almost any purpose except popping. Popcorn is for snacks or used as a cold cereal after popping or can be ground into quite acceptable meal. In my experience I have found it difficult to hull popcorn with alkali treatment for making hominy (posolé, nixtamal) though your mileage may vary. Popcorn is one form of a whole grain available to nearly everyone in the U.S. It is so common a snack food, particularly at movie theaters, fairs, and ball games, that the smallest of towns will often have at least one business selling it cleaned, dried, and ready to pop in twenty-five- or fifty-pound bags. Popcorn is harder than other varieties of corn so if your mill is not of the heavy-duty sort you may want to consider cracking the kernels into coarse pieces first then grinding into finer textured meal. The Family Grain Mill states that it should not be used to mill popcorn at all and the Back To Basics mill should not be used for any great quantity. All other manual and electric mills that I am aware of will mill popcorn without problem. Once you've decided on your preferred corn type you may also be able to choose your preferred color. There are yellow, white, blue, red, and multicolored varieties. The yellow and whites are the most common by far with the blues, reds, and parti-colored varieties mostly being relegated to curiosities, though the blue and red corns have been gaining in popularity these last few years. These would be worth investigating if you can find a good source. It should be kept in mind that white corn does not have the carotene content (converts into vitamin A) of yellow corn. As vitamin A is one of the major limiting nutrients in long term food storage, any possible source of it should be utilized. For this reason, I suggest storing yellow rather than white corn. Additionally, much of the niacin content of corn is chemically bound up in a form not available for human nutrition unless it has been treated with an alkali. This is really of importance only if most of your sustained daily calorie intake will come from corn, but grits, hominy (posolé) or corn masa (for tortillas and tamales) are traditional uses of this grain and can go a long way toward increasing the number of recipes you can make with corn. Give them a try, they're quite good. Any grain as widely grown as corn is naturally going to be processed into many products. Here are a few suited for use in home storage programs.

Corn Meal (polenta meal):

This is simply dry corn ground into a meal. Corn meal intended for polenta may be found in either a coarse or a fine grind. In the U.S. corn meal for making corn bread and most other uses is typically ground to a fairly fine meal. Very finely milled corn is often used for breading foods to be fried and is known as corn flour to distinguish it from coarser meals. This sometimes causes confusion because corn starch (see below) is also known as corn flour in Great Britain - a very different product and not really interchangeable. The germ of the corn kernel contains about twice the oil content of wheat and is highly susceptible to rancidity once the kernel is broken in the milling process. Because of this most commercially available corn meal will have had the germ and hull removed to extend shelf-life then nutritionally enriched to make up for some of the vitamins and minerals lost with the grain germ. This is desirable for the miller and the grocer, but for the diner it comes at a cost of flavor and some of the nutrition of the whole grain. Some grocers may offer a whole grain corn meal that keeps the grain germ and bran which gives a superior flavored product and retains the full nutrition of the grain but makes for a more perishable commodity. If you go this route, be sure of your product's freshness then store it in your refrigerator or freezer.

The grocer's corn meal is mostly milled from yellow or white corn, but some suppliers are now offering blue or even red corn meals. The flavor of the degerminated yellow and white meals are largely indistinguishable from each other, but blue and red corns are interestingly different. Might be worth investigating if you can find them. Storage life of degerminated corn meal is about one year in average conditions in store packaging and a good deal longer if you repackage it for long term storage. Whole grain meal is good for about four weeks on the shelf, months in the refrigerator, and several years in the freezer or if carefully put up in oxygen free packaging. If you have a grain mill, I recommend storing your corn meal in the form of whole corn and milling it as needed. This is what we do, milling a few weeks' worth of meal at a time then keeping it in the freezer until needed. The fresh whole grain meal has a much fuller corn flavor than the degerminated meal from the grocery store.

Hominy (posolé'): This is corn with the hull, and possibly the germ, removed. Hominy cooks faster than unhulled whole corn, is easier to digest, and in some circumstances the alkali peeled varieties can present a superior nutritional profile to whole corn. There are two methods of producing hominy: Mechanical dehulling in a wet milling process or by treating with one of a number of various alkalis such as industrial lye (sodium hydroxide), wood ash lye (mostly potassium hydroxides) or by using some form of lime (calcium hydroxide). Dry lye peeled hominy is now seldom found for sale, but canned white or

yellow hominy is still common across the Southern U.S. and many other areas as well as in Latin American groceries. Generally speaking, hominy produced using lime is known by its Spanish name – posole’ – but this will not always be clear on labels. I have seen can labels of lime peeled hominy simply called hominy. Whether this is important to you depends on the particular flavor you are trying to achieve in the dish you are preparing. Freshly hulled corn using the lime process that is to be ground to make masa (dough) for corn tortillas is called nixtamal. Dry posole’ can be found in Latin American groceries or ordered from the Internet in nearly any color that corn offers. There’s a world of things that can be done with hominy other than simply heating it up and serving with butter and salt. A few minutes spent searching the Internet will produce dozens of recipes using hominy as a major ingredient. It’s an excellent ingredient in hearty soups and stews.

Hominy Grits: Usually just called “grits” this coarsely ground meal can be either simple whole corn ground coarse or corn that has been hulled in a process using a form of lye to make hominy then dried and coarsely ground. Grits produced from lye peeled corn typically cook faster, have a longer shelf life, and presents a different, possibly superior, nutritional profile than the whole grain product. Grits produced from whole corn take much longer to cook, have a short shelf life if not refrigerated or put up in special packaging, a superior flavor to the lye peeled product, and retains the nutrition of the whole grain. Very coarsely ground grits is also known as samp. Hominy grits in the U.S. must be enriched like many other refined grain products and are now typically industrially produced. They are usually what you will find at your local grocers. Whole grain grits are primarily the product of grist mills making stone ground products and are often found in living history demonstrations, heritage fairs, pioneer day celebrations, and so on. Both yellow and white corns are commonly milled for grits and which one you should buy probably depends on what you ate growing up. If you’re indifferent as to the color of your grits then I suggest buying yellow corn grits as the beta carotene content of yellow corn can be converted by our bodies into Vitamin A whereas white corn has none.

Masa Harina: In Spanish “masa” means “dough” and “harina” means “flour” which is a straight forward description of what masa harina is: A lime peeled corn that has been dried and milled into meal to be made into tortilla dough. It’s flavor is distinctively different from either corn meal or hominy grits and is used in making tortillas, tamales, and many other Southwestern, Mexican, Central and South American dishes. Can often be found in mainstream grocery stores and grocers catering to a Latin American trade. Will store on the shelf for about a year and even longer if refrigerated or put up in good storage packaging. If you have a mind to try making your own tortillas you will save yourself much time and

effort by using a tortilla press. These can be found in some groceries catering to a Latin American clientèle or ordered over the Internet.

Corn Starch: A common starch used as a thickener. Made by a roller milling process removing the hull and germ leaving behind a nearly pure starch. Storage life is indefinite if kept dry. In the United Kingdom and some other areas it is known as corn flour which occasionally causes confusion with very finely milled corn also known as corn flour here in the States. The two products are largely not interchangeable.

MILLET:

Millet is an important staple grain in North China and India, but is little known in the U.S, where we mostly use it as bird feed. The grain kernels are very small, round, and usually ivory colored or yellow, though some varieties are darker. A lack of gluten and a rather bland flavor may account for the anonymity of this cereal. Millet has a more alkaline pH (and a higher iron content) than other grains which makes it very easy to digest. A major advantage of millet is that it swells a great deal when cooked and supplies more servings per pound than any other grain. When cooked like rice millet makes an excellent breakfast cereal. It has little gluten of its own, but mixes well with other flours. Adding whole millet kernels to the dough can add a pleasant crunch to your homemade breads.

OATS:

Though the Scots and the Irish have made a cuisine of oats, it is mostly thought of in the U.S. as a bland breakfast food. Seldom found as a whole grain, it's usually sold processed in one form or another. Much like barley, the oat is a difficult grain to separate from its hull. Besides its longtime role as a breakfast food, oats make an excellent thickener of soups and stews and a filler in meat loafs and casseroles. Probably the second most common use for oats in America is in cookies and granolas. A little creative thought can really increase their culinary range. Listed below are the forms of oats found in the U.S. Rolled and cut oats retain both their bran and their germ.

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

Steel cut oats: Also known as Irish, pinhead or porridge oats. They are oat groats cut into chunks with steel blades. They're not rolled and look like coarse bits of grain. Steel cut oats can be found in many supermarkets and natural food stores. They take longer to cook than rolled oats, but retain more texture. They need oxygen free packaging to be kept at their best for long term storage.

Rolled oats: These are also commonly called old fashioned, thick cut or porridge oats. To produce them, oat groats are steamed and then rolled to flatten. They can generally be found wherever oats are sold. They take slightly longer to cook than do the quick cooking oats, but they retain more flavor, texture and nutrition. This is what most people will call to mind when they think of oatmeal.

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

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

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

QUINOA:

Quinoa is yet another of the grains that is not a true cereal. It's botanical name is *Chenopodium quinoa* (pronounced "keen-wah"), and is a relative of the common weed Lambsquarter. The individual kernels are about 1.5-2 mm in size and are shaped rather like small flattened spheres. When quinoa is cooked, the germ of the grain coils into a small "tail" that lends a pleasant crunch when eaten. Some forms of this grain have a bitter tasting water soluble component that should be removed by a thorough washing unless this was already done by the processor as most of the quinoa sold in the U.S. apparently has. 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.

RICE:

Rice is the most widely consumed food grain in the world with the U.S. being the leading exporter of this important staple, though we actually only produce about 1% of the global supply. The majority of the

world's rice is eaten within five miles of where it was grown. Much like wheat and corn, rice comes in a number of varieties, each with different characteristics. They are typically divided into classes by the length of their kernel grains; short, medium and long.

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

Medium grain rice: The medium grain variety is not very common in the States. It has flavor like the

short variety, but with a texture more like long. **Long grain rice:** The long grain variety cooks up into a

drier, flakier dish than the shorter types and the flavor tends to be blander. It is the most commonly

found size of rice on American grocery shelves. Each of the above may be processed into brown, white,

parboiled or converted, and instant rice. Below is a short discussion of the differences between the

various types.

Brown rice: This is whole grain rice with only the hull removed. It retains all of the nutrition and has a

pleasant nutty flavor. From a nutritional standpoint it is by far the best, but it has one flaw: The essential

oil in the germ is very susceptible to oxidation and soon goes rancid. As a result, brown rice has a shelf

life of only about six months unless given special packaging or storage. Freezing or refrigeration will

greatly extend this. It's possible to purchase brown rice from long term food suppliers already specially

packaged in air tight containers with an inert nitrogen atmosphere or you can do it yourself. In this kind

of packaging, (if properly done), the storage life can be extended for several years.

Converted rice: Converted rice starts as whole rice still in the hull which undergoes a process of soaking

and steaming until it is partially cooked. It is then dried, hulled and 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. Its storage life is the same as regular white rice.

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 is lost, white rice sold in

the U.S. has to be "enriched" with vitamins to partially replace what was removed. It stores very well

and is generally the cheapest form of rice to be found in the market place making it a very common

storage food.

Instant rice: The type of rice is fully cooked and then dehydrated needing nothing more than the

addition of water to reconstitute it. In a pinch, it's not even necessary to use hot water. It's not

particularly suitable for inclusion in storage programs, but may have a place in “seventy-two hour” and other short-term emergency kits. The white variety is by far the most common, but in the last few years instant brown rice has made an appearance on the market.

RYE: Rye is well known as a bread grain in the U.S. It has dark brown kernels longer and thinner than wheat, but less gluten. Rye flours can be found in varying stages of refinement from dark whole grain flour to semi-refined medium to pale fully refined offerings. Bread made from this grain tends to be dense unless gluten is added (often in the form of a lot of wheat flour). German pumpernickels and Russian black breads, made with unrefined rye flour and molasses, are two of the darkest, densest forms of rye bread. Many sourdoughs are built upon a rye base with a resulting interesting, intense flavor.

SORGHUM: Sorghum is probably more widely known here in the States for the syrup made from the sweet juice squeezed from the stalks of some varieties of this grain. Also known as “milo”, it is one of the principal cereal grains of Africa. Its seeds are somewhat round, a little smaller than peppercorns, of an overall brown color with a bit of red and yellow mixed in. The varieties called “yellow endosperm sorghum” are considered to have a better taste. It is a major feed grain in the Southwestern U.S. and is where the vast majority of the national production goes. 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 into meal for porridge. It’s also fermented for alcoholic beverages.

TEFF: Easily the smallest of the grains, teff kernels are only about 1/32nd inch in diameter. The name itself means “lost” because if dropped on the ground, it’s too small to recover. It’s been very little known until recently, but has been a staple grain in Ethiopia for nearly five millennia. Small amounts are now being grown in South Africa and the United States. This grain ranges in color from reddish brown to near white. It has a protein content in the 10- 12% range, good calcium and a useful source of iron. It is traditionally used in making the Ethiopian flat bread “injera”, but has no gluten content of its own. It’ll combine well with wheat flour though and has something of a sweetish flavor.

TRITICALE: Triticale is not a creation sprung from the smooth brows of Star Trek script writers. It is, in fact, a cross between durum wheat and rye. This youngest of grains combines the productivity of wheat with the ruggedness of rye and has a high nutrition value. The kernels are gray-brown, oval shaped larger-than-wheat and plumper than rye. It can be used in much the same way as either of its two parents. It will make a raised bread like wheat does, but its 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.

WHEAT: The most widely consumed grain in the United States and along with rice and corn one of the three most widely grown in the world. Wheat is also one of the most intensively processed to turn into food of all the grains. It comes in a number of different varieties each more suitable for some purposes than others based on its particular characteristics. The most common classifications of these varieties are based on their respective growing season, hardness of kernel, and color of their bran layers - spring or winter, hard or soft, red or white.

The hard wheats have kernels that tend to be small, hard in texture, and with high protein (primarily gluten) contents. As a general rule, hard varieties have more protein than soft varieties. Yeast raised breads that need a lot of gluten are where it's at for the hard wheats.

The soft wheats have kernels tending to be larger, plumper and softer in texture than hard wheats. As their gluten content is lower they are primarily used in biscuits, pastries, quick breads, some pastas, and breakfast cereals where a higher gluten content would contribute an undesirable tougher texture. Soft wheats do not produce as fine a loaf of yeast raised bread as high gluten hard wheat, though it can still be used for yeast breads by combining with higher gluten flours or using methods suitable for its protein level. Many traditional European yeast raised breads are made with lower protein flours.

Durum wheat also has a very hard kernel and a high protein content, but of a somewhat different nature than the other hard wheats. Durum is not primarily used for breads but is instead consumed mostly in the manufacture of pasta where it lends its characteristic yellowish color to the finished product. There are some specialty breads that call for durum/semolina flour so it can be used for bread making even if it's not best suited to the task.

Winter wheats are planted in the Fall, over winter in the field, grow through the Spring and are harvested early the next Summer. Spring wheats are planted in the early Spring and are harvested the following 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 very suitable for yeast raised bread making. Some feel the hard white varieties make a better tasting whole wheat bread than the hard reds and I am inclined to agree. When milled, whole grain hard white wheat flour looks somewhat like unbleached refined white flour in appearance.

The hard red varieties, either spring or winter, are commonly chosen for storage programs because of their high protein content which should be no less than 12% with 14% or more being excellent. The hard white spring wheats are still relatively new and not yet as widespread but are steadily growing in popularity. They have the same excellent storage characteristics as the hard red wheats and should be selected with the same protein contents as well.

With so many different varieties of wheat it should come as no surprise that there are a number of different types of wheat flour offered to the home baker. Distinguishing between the array of products available through both retail grocery stores and commercial supply houses catering to bakers nearly requires the knowledge of a professional baker or a cereal chemist and would take up page after page to explain it all. Instead, I will briefly cover only those flours or flour products that one can usually find in supermarkets in the U.S. and elsewhere. If you need more advanced knowledge in order to purchase through commercial or institutional food channels I recommend taking your questions to the Usenet newsgroups rec.food.baking, sci.bio.food-science, or alt.bread.recipes where you may be able to get answers from professionals in the field.

All Purpose Flour: Of all the flours in the retail market all-purpose flour is the one most subject to major differences between brands, regions of the U.S., and/or other nations. This refined flour is typically made from a blend of hard and soft wheats with a protein content that can range from as low as 8% to as high as 12%. The regional brands of the Southern U.S. have traditionally been on the lower end of the protein scale. This is due to the fact that historically only soft wheats were grown in the South and the resulting flour was best used in making biscuits and other types of non-yeast raised breads that did not require high gluten levels. The regional brands of the Northern U.S., and Canada are typically at the high end of the protein scale at or approaching 12%. This is because hard wheats are primarily northern grown and are well suited to making yeast raised breads which need higher gluten levels as were customarily made there. The national brands either differ by region or are in the 10-11% range in an effort to try to satisfy all markets.

In the U.S. all-purpose flour is enriched and can be had either bleached or unbleached and may possibly have small quantities of malt added as well (see below about enrichment, bleaching and malting).

As the name implies all-purpose is meant to serve as a general all-around flour from which you can make anything from cakes and pie crusts to sandwich bread. So far as it goes you can, but it's a lot like one-size-fits-all clothing in that chances are it won't work as well for a given project as a flour milled

with that particular use in mind. The lower protein all-purpose flours sold in the Southern U.S. will produce a more tender biscuit, cake, or pie crust than the higher protein all-purpose flours of the Northern U.S. and Canada, but unless you use some special techniques (like how true French bread is made) it won't produce a very satisfying loaf of yeast bread. The flours in 10-11% range try to strike a happy medium between the two, but still won't serve as well as flour produced specifically with a given end use in mind. If you want to limit the number of types of flour you put into your storage program I'd recommend going with the 10-11% flours and either plan on adding gluten as needed to make the best yeast raised breads or cornstarch to produce more tender cakes and pie crusts.

In the United Kingdom and Canada all-purpose flour is oft times labeled as "plain flour", "top patent", "general purpose", or "family flour."

Bread Flour: A refined white flour with a higher protein (gluten) content than most all-purpose flours to achieve better performance in making yeast raised breads. Protein levels should be at least 12% with 13-14% better still bromate to improve gluten qualities, but concerns over possible toxicity of this additive is leading to its diminished use. A high gluten refined bread flour is commonly added to whole wheat doughs to strengthen them which can improve loaf rises and volume. Bread flour is most commonly used in the production of yeast raised breads, pizza crusts, and some specialty baked goods. In Great Britain bread flour is often labeled as "Strong Flour" meaning it has a high protein content.

Whole Wheat Flour: Real whole wheat flour should include 100% of the bran and germ so read your ingredient labels carefully to be sure this is so. This flour is mostly milled from hard red wheats, but whole grain hard white flour is available from some mills and will produce a bread that looks closer to refined white bread if that is what you are accustomed to eating. Protein contents can vary, but as most whole wheat flour is used in yeast bread making it should be at least 12% with 13-14% being better still. This is good because the bran and the germ can interfere with good gluten development as the dough is mixed and kneaded. Some do not mind this while others strengthen their flour by adding vital wheat gluten or high protein refined bread flours to achieve the rise and volume they are accustomed to in yeast breads. Approximately 90% of the total protein of a kernel of wheat is gluten with the remaining 10% other proteins being mostly found in the grain germ. Refined flours have had the germ removed so a statement of protein content can be taken as an indication of that flour's suitability for making raised yeast breads. With whole wheat flours one must remember that ten percent of non-gluten germ proteins and judge that flour's protein content accordingly. Whole wheat flour milled from lower

protein soft wheats may be offered as “whole wheat pastry flour” so be sure of what you are buying. Some whole-wheat flours are also enriched.

Whole wheat flour may also be called “Graham Flour”, sometimes simply “Stone Ground Wheat Flour” and in Great Britain, Canada, and Australia may be known as “Whole Meal Flour.” In Britain there is also a “Brown Flour” which is midway between whole meal and white flour in that it retains about 85% of the wheat kernel rather than only the 72-75% that is typical of refined white flours.

The real disadvantage to storing whole wheat flour is that like other processed grain products that includes the oil rich germ it wants to go rancid. How fast this can happen depends upon temperature, moisture, etc, but four to six weeks is generally enough time for rancidity to become noticeable. One can, of course, package the flour in good containers with oxygen absorbers and the like, but better still would be to buy the flour in the form of whole wheat berries and mill them yourself. This is exactly what I and many other folks with food storage programs do. Baking with fresh, whole-wheat flour is something of an art so the time to get good with it is right NOW while you can toss your failures to the chickens rather than having to eat them regardless because you can't afford to waste the food.

Vital Wheat Gluten: Sometimes labeled as simply “wheat gluten.” This is the purified gluten of hard wheat extracted from flour. It is generally 75-80% protein and is used to strengthen weak or whole grain flours for making yeast raised breads or made into “seitan” a wheat protein meat substitute. Somewhat confusing the issue is “High Gluten Flour” which is available in some markets. Careful investigation is needed here because this flour can range from a mere high gluten bread flour (approx 14%) to a gluten enriched flour typically 40%+) all the way up to purified wheat gluten (75%+). Be clear as to what it is you're buying and if you're not certain contact the manufacturer. If your whole wheat bread is not rising for you as much as you'd like then an addition of a few spoonfuls of gluten or some high gluten flour may perk it up a bit.

Cake Flour: Typically, the lowest protein content (6-8%) flour available to the home baker. This highly processed flour will make the tenderest cakes, cookies, and biscuits but performs poorly for yeasted breads. The flour is nearly always bleached (chlorinated) both to give it a bright whiteness and to improve its moisture holding capacity for cakes calling for a high ratio of sugars or fats. Unless you make a lot of cakes this is a rather specialized item to store.

Pastry Flour: Similar to cake flour, but generally slightly higher in protein, not chlorinated, and may be found bleached or unbleached. Used to produce tender pie crusts, biscuits, etc. Very similar to the

regional all-purpose flours of the Southern U.S. Can also sometimes be found in a whole-wheat version as well. In Great Britain, Canada, and Australia may be known as “soft flour.”

Semolina/Durum: Produced from durum wheat this flour is typically high in protein, 12% or more, enriched, unbleached with a distinctive pale-yellow color. Texture depends largely on brand and can range from fairly coarse to bread flour fine. Most commonly used in the production of pastas, noodles, and couscous, but some specialty bread types call for semolina flour. May also be known as “alimentary flour”, “macaroni flour”, or “pasta flour.” Farina, a coarse meal used as a breakfast cereal, is made from durum wheat.

Self-Rising Flour: This is ordinary refined and enriched all-purpose flour to which approximately 1.5 teaspoons of baking powder and 0.5 teaspoons of salt have been added to each cup of flour. This flour has its fans, but it’s not well suited to long storage as the baking powder wants to go flat over time even with special packaging. Nor is it suited to making yeast raised breads. Most self-rising flours are in the mid to low end of the protein scale (8-10%) because this is where chemically leavened quick breads perform best to achieve good rises and textures. You can make your own self-rising flour by adding in the requisite amount of double acting baking powder and salt mentioned above which is what I recommend doing rather than trying to store the ready-made product. Self-rising flour is sometimes known as phosphated flour (for the baking powder used in it) and in Great Britain, Canada, and Australia may be known as “self-raising flour” or “raising flour.”

Instant Flour: This specialized flour product is also sometimes known as “shaker flour” for the shaker can in which it’s usually found This is a low-protein flour in a granular form processed for easy and rapid dissolution into hot or cold liquids for making sauces, gravies, and batters. A fairly specialized item which any worthy cook can use ordinary flour to replace.

FLOUR TREATMENTS AND ADDITIVES

Flour milling companies (and home bakers) use a variety of additives and treatments in their flours to improve or suppress a particular quality in their product. If you read the package labels carefully you can discern quite a lot about what has and has not been done. Here are a few of the more common:

Enrichment: U.S. law (and some other nations) requires that refined flours which have had their bran and germ portions removed to be “enriched” by adding back a portion of the niacin, thiamin, riboflavin, folic acid, and iron that were lost in the refining process. Some milling companies go even further by adding vitamins A & D as well. There are various opinions about the value of this enrichment, but it’s

there. It has no affect on the taste, color, texture, caloric value, or baking qualities of the flour. Outside of the U.S. refined white flours may or may not be enriched so study your package labels carefully if this concerns you.

Bleaching: White bread and white cakes come by their snowy beauty thanks to bleaching. This is a process by which the yellowish carotenoid pigments that naturally occur in wheat are bleached white in order to improve the appearance of the flour and perhaps to change some of its physical characteristics as well. This would occur naturally by itself were the refined flour allowed to sit around for several months, but it's an uneven process and time is money to the milling companies who cannot afford to have large stocks of product sitting around in their warehouses for long periods of time.

Beyond making naturally off-white flour snowy in appearance bleaching can perform several other functions which the individual baker must decide if they are important to his needs. Until fairly recently much refined flour was also "bromated" using potassium bromate both to lighten the color, and to improve the qualities of the gluten. Concerns over the toxicity of this chemical has led to its gradual decline or outright ban on its use. Other bleaching agents are now used such as chlorine gas, chlorine dioxide, benzoyl peroxide and possibly others as well. Flours treated in this fashion will often exhibit improved loaf volume, finer grain, and look better in the finished product.

Cake flour is generally chlorinated not only whiten but also to improve its moisture holding ability when used in cakes with a high ratio of sugar and fat to flour. This bleaching also further tempers the already low gluten of the flour to produce the tenderest possible texture.

For the folks who do not care to buy bleached flours, small amounts of ascorbic acid (vitamin C) are often added as a dough conditioner and yeast nutrient. Home bakers often add their own vitamin C to their breads when they make them for the same reasons. A mere 1/8 tsp of ascorbic acid per cup of flour is all that is necessary.

All bleached flours must be so labeled in the U.S.

Malting: Many bread flours and some all-purpose flours will have small amounts of malt, malted barley flour, malt flour, or diastatic malt added to them. This additive improves the performance of the yeast by providing enzymes which speed the conversion of some of the flour starches into the digestible sugars the yeast use as fuel which can improve both the rise of the dough and the flavor of the finished product. The malt can also serve to improve the appearance of the bread when baked and lengthen its

shelf life. You can add your own diastatic malt in the ratio of about 0.5-1.0 teaspoons for every three cups of flour.

Organic: This is flour produced and processed under the guidelines of the U.S. Department of Agriculture's Organic foods program. Most of the basic flour types (all purpose, bread, pastry, etc.) can be found in organic forms though you may have to search a bit to find them.

Pre-Sifted: This is flour sifted at the mill before it was packaged. Supposedly this means you do not need to sift it again at home, but many feel that due to settling during transport and storage if the recipe calls for sifted flour it should be done again.

Other Additives: There are many other potential additives that you may potentially come across in flour which would require more space than is possible here to cover them. Most are for use within the commercial/industrial baking fields and you would need to contact the supplier to determine precisely what it is they can do for you.

STORING FLOUR PRODUCTS

As already mentioned above whole wheat flour wants to go rancid rather quickly after it has been milled. Once ground it will stay fresh for about four to six weeks sitting on your room temperature kitchen shelf. In a sealed container in the refrigerator the flour will stay good for a year or so. In the freezer it will keep for years. Personally, I think it best to store your whole wheat flour in the form of wheat berries and only mill as much flour as you will use in a week or two and keep that in the refrigerator or freezer until you do. If for some reason you cannot do this then buy the freshest product you can and package it well in Mylar bags, glass jars, or metal cans with oxygen absorbers. Due to the fine texture of flour it will not gas flush very well at all.

Even the refined white flours have limited shelf-lives. In spite of what some would have you believe they are not "dead foods." The bran and germ may have been removed, but a minute portion of the germ oils will remain as well as the naturally occurring enzymes found in the grain. Refined white flour won't noticeably go off on you the way whole wheat flour will, but given sufficient time and exposure to heat and atmospheric humidity the protein content of the flour will slowly breakdown. Your first indications of trouble may be a slowly developing musty smell or degraded dough performance – poor rises and bad loaf volumes. In a sealed, air tight container you should easily achieve six months to a year at room temperatures. Sealed containers in the refrigerator or freezer will last for at least several years. If you want your white flour to stay at its best for the longest possible time then package it in Mylar bags, glass

jars, or metal cans air tight with oxygen absorbers. At a decent storage temperature sealed in a low oxygen environment you should easily achieve five years of shelf life or more.