**The Basic Elements of Bread**

**The Basic Loaf of bread:**

A totally natural, basic bread consists of three basic elements; Flour, Water and Salt. Of these, flour is the most important and is a topic far too enormous to cover in a few hours. There are six classes of wheat cultivated, within which there are 30,000 varieties.

**The Six Classes of North American Wheat:**

Hard Red Winter, Hard White Winter, Hard Red Spring, Durum, Soft White Winter, Soft White Spring

The first four, are what interest the bread baker.

* **Hard Red Winter Wheat**
* **Hard White Winter**

Winter wheat, both Red and White is grown in areas with relatively gentle winters, N. Texas, E. Colorado, Nebraska and Kansas being the major growers. It is sown in September, October, sprouts and grows about 5-6 inches prior to winter’s arrival. It goes dormant and ideally is protected by snow cover until spring, when it resumes growth. It is then harvested from May to mid-July.

Hard winter wheat protein levels are typically 11 to 12 percent, lower than spring wheat at 13 to 15 percent, but the proteins are believed to be superior, specifically for the production of artisan breads with long fermentation times, folds, etc. as high gluten flours in general do not support long fermentation and the dough tends to lose structure and stability. The flour we utilize in our bakeshop for Naturally leavened, artisan breads, “Artisan Baker’s Craft-Malted” from Central Milling of Utah, falls into this category with 11.5% protein. We also have “High Extraction” flour that is 12 % to 12.5% protein. It is our Central Milling Old Craft Type 85, or 85% extraction. Extraction is expressed in a percentage, reflecting the yield of the whole wheat after milling, thus Whole Grain flour is 100% extraction.

* **Hard Red Spring Wheat**

Hard Red spring wheat has a different growing culture. It is sown in areas with harsh winters. In the USA, the Dakotas, Minnesota, Montana. In Canada, Alberta, Saskatchewan and Manitoba. The seed is planted in spring, goes through it’s entire growing cycle in spring and summer to be harvested in mid to late summer. These are where our high gluten flours are derived, with protein from 13 to 15 percent. These flours are utilized where the baker needs extra lift, as with heavy grain breads, or when producing pan breads, where volume of the finished loaf is key to quality. The flour we utilize for our mechanically mixed dough, using commercial yeasts utilize this type flour.

* **Durum Wheat**

Durum wheat is grown primarily in N. Dakota and used in the production of pasta. It has limited applications in bread making, as despite being the highest in proteins, they are not fully usable in the formation of gluten. Dough high in Durum, have a tendency to break down during mixing, thus requires a close eye during dough development. Semolina flour is made from Durum but it differs from the soft, golden Durum flour as Semolina when milled, has a coarse, sandy texture which punctures the dough, adversely affecting dough strength and volume.

* **Soft White Winter**
* **Soft White Spring**

The last two, above, we are not concerned with in bread production, as they are low protein flours that are better suited for pastry, cake and cookie production.

**Rye:** Because of the popularity in the bakeshop, I do want to discuss rye flour a bit. It is extremely important to many parts of Europe, and is held in high esteem in Russia, Poland, Germany, Austria and Scandinavia. Rye is grown in areas that are inhospitable to wheat. Rye thrives in poor soil, cool environments, and yields a good crop in areas of high humidity. Breads made from rye flours, have a distinct aroma, a bold, unique flavor, excellent keeping and eating qualities quite different from wheat flour breads. Unfortunately in America, we far too often mask the true flavors of rye, with the addition of caraway seed, rarely used in European rye breads.

While rye is high in protein, because it’s high in the polysaccharide, pentosan, gluten does not form, thus without added ingredients, (often bread flour) it is a dense heavy loaf.

**The Wheat Kernel:**

Bran, Germ and Endosperm

**The Bran:**

The wheat kernel is enclosed with several outer layers of husk, called the pericarp. These layers protect the germ and endosperm. The edible bran is just inside the pericarp. The innermost layer, known as the aleurone, (technically the outer surface of the endosperm), is very rich in nutrients. The bran layers make up approximately 14% of the wheat kernel.

**The Germ:**

This is the heart of the embryo. While accounting for only 2.5% to 3.5% of the kernel, it is packed with vitamins, minerals and fats. When planted, it is from the germ, that the initial root and shoot of the plant emanate, providing the concentrated food source to the developing plant. It is because of the concentration of fats, that the germ potentially becomes rancid, thus the importance of stock rotation for bakers using whole grain flours. As is done with the bran, the germ is removed, in its’ entirety, prior to the milling of white flour.

**The Endosperm:**

This is the storehouse of starch and protein. It provides long-term nutrients for the developing kernel with protein levels ranging from 10% to 14%, while coexisting with starch in inverse proportions (from 70% to 73% of total kernel weight). Flour that is higher in protein, are lower in starch and vice versa. It is within the endosperm we find the two proteins, (gliadin and glutenin), that bond to form gluten when mixed with water, thus giving us dough. Mixing develops more gluten thus giving not only cohesive structure to the dough, but also allows the carbon dioxide gases to accumulate in the gluten network. When baked, wheat dough gains a lightness of structure that cannot be duplicated with any other cereal grain.

**Glutenin:** gives elasticity, enabling dough to resist extension but this elasticity supports structure during fermentation. On the bench, this resistance is needed to achieve proper shaping.

**Gliadin:** Gives the dough extensibility, or the ability to extend into a desired shape.

When the two are combined, and in balance (not the case with many grains) the baker is able to manipulate the dough into the desired lengths and shapes without tearing.

**Field to Mill:**

After wheat is harvested it is allowed to rest for about 6 weeks, prior to going to a mill. This is called “sweating” and during this time some metabolic changes occur that improve the milling quality of the grain. The moisture reduces slightly, from about 17% in the field to 14% once milled.

Once sweating is complete, the wheat is shipped and steps are then taken to remove impurities. When finished, the wheat berries go through a process called “Tempering”, where moisture is added, usually chlorinated water to prevent bacterial growth. This softens the endosperm, while toughening the layers of bran. In the US, tempering lasts about 6 hours, (time is money you know) while in Europe it can last from 24 to 48 hours. It is in the best interest of the baker, for the wheat berries to be converted into flour with the shortest milling time. In the US, we have gone from 23,000 mills in 1873, to 300 in 1973 and barely 200 in 1993.

Once tempering is complete, the grain is milled, being broken between two corrugated, steel rollers. It is “bolted” or sifted, followed by further breaks or “reductions”, (5 or 6 typically) that remove the bran and germ from the endosperm. As the size becomes increasingly smaller, more flour is obtained from the siftings. Extracting as much of the endosperm as possible, the remaining bran and germ are used to feed animals, thus you often find feedlots near mills.

**Some Ancient grains coming back to the forefront:**

**Einkorn (**One Seed**):** This is the original, wild wheat that grew in an area known as the” fertile crescent” in what today is Iraq and Syria. Plantings today are limited with small plantings in Turkey, India, Italy, France and Yugoslavia. There are indications that this wild wheat is non-toxic to those with Celiac disease, a benefit to continued production.

**Emmer:** Another wild wheat with similar heritage, it surpassed einkorn as a cultivated crop but again is in very limited production today. Both Einkorn and Emmer produce well in adverse conditions with yields surpassing many other grains, including common wheat.

**Spelt:** While appearing later, 6000 BC, in what today is Iran, spelt has continued to be a highly cultivated, secondary grain. In Germany it is called “Dinkle”, Italy “Farro”. It is high in protein with sufficient gluten to produce breads with reasonable volume. Spelt is often tolerated by those with wheat allergies. It is a “covered wheat”, the kernels enclosed on the plant, making it more difficult and thus expensive to harvest. This is why US production is extremely low.

**Kamut:** Originally from Egypt, this is a registered grain, (trademarked grain and name) by Kamut International. It is grown in Montana and North Dakota. It is 20%-40% higher in protein than common wheat, but gluten quality is low. Certain folks for whom common wheat is toxic are able to tolerate Kamut.

**Common Grains and Seeds:**

Sunflower, Flax, Sesame, Fennel and anise seed and Millet, Oats, roasted Barley, Rye and Wheat berries, Cornmeal and other grains are utilized to enhance flavor and give subtle variations.

**Water Absorption:**

A general rule is, the higher the protein content, the more water the flour absorbs. Whole grain and rye flours will also absorb more water. It is important for the baker to understand this correlation between protein content and water absorption, especially when working with new flour types.

* Water is required for gluten development
* Water serves as a dispersing agent for salt, sugar, and yeast.
* Water is necessary for yeast fermentation/reproduction. Softer dough ferments quicker than dryer dough.
* Water is responsible for bread dough consistency.
* The temperature of water can determine correct dough temperature.

**Commercial Yeast:**

* **Fresh or Compressed:** Is active and ready to use. Provides instant yeasty flavor.
* **Active Dry:** Must be activated in 4 times it’s weight of warm water. A sponge is made using a portion of the water, flour and sometimes sugar to activate this.
* **Instant Dry:** Is combined with dry ingredients, becoming active with the introduction of liquids into the mix. It easily rehydrates and reproduces more readily, thus smaller quantities are required.
* **Instant Dry-Osmotolerant:** A strain designed for use in enriched dough,requires less water, thus when competing with sugar for moisture, is more efficient.

**Conversions:**

* **Fresh Yeast to Active Dry:** Weight of Fresh Yeast x .4 = new weight
* **Fresh Yeast to Instant Dry:** Weight of Fresh Yeast x .33 = new weight

Yeast requires moisture, oxygen, a suitable temperature, and food to reproduce for fermentation. Bread dough provides all these elements and is perfect environment

**Salt:**

* Salt inhibits the reproduction of yeast, thus the fermentation process can be controlled through the use of salt.
* Salt strengthens gluten, allowing it to become more stretchable, thus gives extensibility to dough. This allows for further stretch without tearing, or pulling back. A more supple dough but with strength still inherent.
* Salt provides flavor, a very important element for those of us who eaten a bread lacking in or without any salt content at all!

**A Few other Players**

**Sugar:**

* Provides sweetness to the bread.
* Provides crust color through caramelization, thus baking temps are decreased when sugar content rises and breads like Challah, containing sugar along with oil and eggs must be baked on sheet pans, not on the deck of a hearth oven, and at much lower temps to prevent burning.
* When sugar levels hit about 10%, yeast activity decreases, because like salt, sugars are hygroscopic, taking water away from the yeast. This comes into play with Viennoiserie products, thus yeast levels are increased to offset this.

**Eggs:**

* Contribute to crust color, thus the use of egg washes but again, temperatures must be lowered to prevent excess coloration. The yolk also provides crumb color, although with current egg production, dyes are used to accomplish what naturally raised chickens once gave us.
* Flavor is given, from the yolk, as the white of an egg has little to no flavor.
* Nutritional values are increased, protein, calcium, iron and potassium, specifically.
* Structure and even texture are given. The proteins coagulate and the lecithin in the yolk helps emulsification, thus even textures.

**Milk:**

* Increases protein and minerals, thus nutritional value.
* Lactose, the sugar present in milk, caramelizes on the surface, contributing to crust color, thus precautions similar to those taken with eggs and sugars must be considered.
* Lactose, and the fats in milk soften the crumb and help the crumb to have an even grain.
* Bakers will often utilize dried milk, shelf life and price being the main factors here. 4 ounces of dried milk, replaces a quart of fresh milk, the liquid made up in using water.

**Fats:**

* Tenderize and create closed grain, tighter crumb by coating gluten strands during mixing, thus limiting their ability to bond together, “Shortening” them.
* Fats, being moisture retainers, are used to increase shelf life and butter is unsurpassed in giving aroma, superb mouth feel, rich color and exceptional taste.
* Unsalted butter is used to control salt content and also, salted in butter is used as a preservative, thus is often older product withy the potential for off flavors to be present.