The Whole Grain Connection Newsletter #27
June 2019

The Baker's Riddle

Refined flour and sifted flour are approximately interchangeable in recipes, whereas neither of these is interchangeable with the same weight of whole wheat flour, to make a loaf with the same dimensions in each case! *How do you explain this riddle?*

Asking bakers for the impossible!

During most of the 1800s the ubiquitous flour, used by most people, had an extraction rate of 85%. The 15% of material removed was mostly bran and germ sifted off from stone milled flour. Inevitably it is the awkward shaped and larger particles of bran and germ that end up on the sieve. **Bran and germ together with the aleurone layer have no volume-making power in bread**. They constitute 20%, more or less, of the whole grain. The result of sifting, or bolting, is a flour very similar in composition to the highly refined roller milled flour produced from about 1880 until now, that is approximately 75% extracted. Bakers could easily continue with their longstanding formulations and methods when using the refined 75% extracted flour. In fact, as you can see from the extraction rate, **this refined 75% extracted flour has the most loaf-volume-making potential possible in any flour**! The bakers were as enthralled then as they are now, with this maximum loaf-volume-making potential. The **75% extracted refined flour is essentially endosperm only;** everything in this flour creates loaf volume.

Fast forward to 2019, and we know absolutely that we need to be eating all that bran, germ and aleurone that is currently absent from most wheat flour. Given our current knowledge of nutrition and disease prevention, it's almost unimaginable that bakers would still be providing practically everyone, with refined flour bread as our basic staple food. What on earth are the stumbling blocks preventing bakers from providing totally appealing 100% whole wheat bread? I'd say that there are two main blocks:

First the current commodity refined flour milling system is incapable of providing fresh 100% whole wheat flour to bakers. Bakers have instead been presented with poor tasting *wet roller milled* whole grain flour mostly from just one kind of wheat, for more than five generations. How can people ever again be persuaded that it is the process and not the wholeness of the wheat that is at fault? Also, the **refined flour millers have no incentive whatsoever to do anything but sell ever cheaper shelf stable refined flour, because the richly nutritious bran, germ and aleurone sells for such a high price to those who feed animals.** This stumbling block can be overcome reasonably and instantly when a baker installs a stone mill, a pulverizing mill or some other kind of impact mill and produces their

own fine, freshly milled 100% whole wheat flour. But it takes a very well educated and devoted baker who would choose to do this.

Secondly, bakers cannot simply be asked to exchange out the refined flour for 100% whole wheat flour. **This is the impossible request to bakers**. This is the stumbling block most in need of overturning and removing.

The solution is at hand but needs considerable thought and effort to implement. Bakers will need a lot, and I mean a lot! of help to achieve the needed change. The most important information to hold in order to bring about this change is that **100% whole wheat flour can only ever possess 80% at the most, of the loaf-volume-making power seen either with refined flour, or sifted flour**.

When looking at current bread formulations the **requirement will be to replace refined flour with 125% to 133% by weight of whole grain flour**. Without this step, current loaf dimensions cannot ever be achieved. Just doing this, is an immediate headache to the baker. **We are asking bakers to replace a very cheap ingredient with a much more expensive ingredient, and more of it!** Suddenly the cost of the loaf increases beyond all recognition. Most bakers immediately fear that they will lose their customers in the ever-raging price war and most bakers dare not make the change! Besides hardly anyone has experienced 100% whole wheat breads made with freshly produced whole wheat flour! Their reference point is five generations who have rejected whole grain breads! Bakers need to stay in business, and they are in the business of providing bread that people already know.

How do we educate everyone in the notion that this **100% whole grain bread contains more and therefore costs more** and that **the increase in price is a bargain**? Whoever heard of such a thing in this era of ever cheaper goods?!

Most of the bakers that I know are artists, historians and musicians. Leaving all this for bakers to figure out without help is a non-starter! **We must be able to define the problem, come up with a workable solution, and enlist the help needed!**

Farmers' goals for wheat matters to us all!

The current commodity system for wheat allows a farmer to completely abdicate responsibility for the destination and use for their crop. Most wheat farmers combine-harvest their wheat into trucks that directly haul their crop away to the coffers of a single buyer, who pays them up front. This suits the wheat farmer mightily until the day arrives when the buyer decides that they can obtain better or cheaper wheat from elsewhere.

Recently wheat export markets that once seemed everlasting have disappeared. Commodity flour mill acceptance of hard-red wheat even if just for *blending* has

faded with the reduction in wheat acceptance. This combined loss of firm markets has made wheat farmers nervous, especially here in California. The next alternative market for wheat has been for organic animal feed. Currently this is an almost insatiable market of the kind that farmers crave. The problem in this case however, is that most wheat farmers are still growing their wheat crop conventionally.

Supposing instead, the wheat farmer aimed to capture profit at every step from seed to table, by owning it together with the other local stake holders in the chain until that final sale in local ready-to-eat form? Is that even a possibility?

Farmers could actually take advantage of the insatiable need for organic and 100% whole grain products, in a vertically integrated system where they jointly controlled the product all the way from seed to table. In this system they could grow the types of wheat truly suited to their farm – instead of only wheat specifically designed to be a certain hardness for the commodity refined flour miller. Making regionally appropriate wheat, and other grain varieties available would allow bakers to make the various bread types with the most appropriate local wheat, instead of creating them with a refined fraction of hard red wheat, which is the current norm. The 100% whole wheat flour could be produced freshly dry milled according to demand from the local bakeries. All this would be possible if the local farmers, grain handlers, millers and bakers formed consortia owning a set of grain cleaning equipment, grain storage, local stone or impact mills and bakeries. Any of the stone mills, hammer mills or impact mills in general, would be able to mill any and every type of wheat to a whole grain flour. *By now we have learned how to make this flour beautifully fine to satisfy the baker*. There would no longer exist the limiting preference by the miller for hard red wheat.

There would be another valuable result for everyone: local community loyalty, diversity and help to maintain that bottom line for all the enterprises in the whole grain food chain from seed to palate.

Can whole wheat flour be too hot from the mill?
The whole grain flour issuing from a stone mill (such as an Osttiroler, Jansen, Meadows, Engsko, or Mock mill) or from a small micronizing mill such as the Blendtec Kitchen mill, can be quite obviously hotter than the ambient temperature. This is especially so for the hardest of grains such as durum wheat. When to worry as to whether the flour has been damaged for breadmaking by such heat, is an ongoing topic for discussion.

Since proteins such as enzymes and gluten begin to denature at about 120°F (49°C), concern begins to mount when the flour is this hot. If the temperature of the exiting flour rises to 130°F (54°C) when theoretically the starch could be

gelatinized (damaged), in the prevailing moisture, the concern is considerable, until experience gives us some respite from the worry.

In practice hot flour cools with great speed. *There is a physics law that observes that cooling is fastest when there is the greatest temperature gradient*. In addition, we realize that these mills send the grain and flour through the mill at tremendous speed, so fast that the grains and flour granules are at their highest temperatures for a minutely short time. I'm now likening this situation to the baker who can handle a very hot loaf with bare hands, without burning their fingers. I can't do this myself and do not recommend it, but this is an example of exposure to very high heat for such a short time that no significant damage is caused by the heat.

Andrew Ross has systematically studied the characteristics of whole wheat flour from several different kinds of mills and suggests from his studies that even if the flour exits the mill at 124ºF (51ºC) the gluten functionality of the flour is not affected. However, I've seen higher temperatures than this, 130ºF (54ºC) when stone milling very hard wheat with a small stone mill, but still seem to make a loaf with the expected quality, except that it is distinctly sweet. I explain this by suggesting that indeed significant starch damage occurred, so that the added enzyme active malt that I use, has plenty of damaged starch from which to release sugars. However, the volume and textural characteristics of the loaves do not seem to be changed.

Even so, the coolest flour production possible is a good goal for the maximum preservation of the lively components of the grain to be present in the flour.

Here are some local efforts in California to make 100% whole grain bread the norm

Country Sun, Palo Alto, CA – Health food store initiating a grand effort to preferentially stock 100% whole grain breads and promote them

Beck's Bakery, Arcata, CA– Wholesale mill and bakery, produces a 100% whole grain specialty loaf of a different kind for order every week

The Midwife and the Baker, Mountain View, CA– Wholesale mill and bakery, produces several 100% whole grain sourdough breads, and now sells to walk-in customers.