

The Whole Grain Connection Newsletter #30 February 2020

A new reality for wheat

In California wheat is still grown as a commodity crop. Acreage in wheat was fairly steady at around 700,000 acres during most of the 1900s. However, there has been a relentless decline in wheat acreage since approximately 2000 so that by now the acreage in California is down to only approximately 400,000 acres in 2019. Explanation for this drastic reduction in commodity wheat production is primarily due to a new realization that its use for centralized refined flour production for humans is no longer the desired norm. The *California Wheat Commission* is charged by California law to derive income through a levy on the sale of this wheat and so provide commodity farmers with research, development and marketing assistance, but it's a losing battle.

The emerging viable alternative to the commodity wheat system for human use, is a localized system with wheat grain stored locally as the commodity product, ready for whole wheat flour milling on demand, by a wide range of end users each owning their own whole wheat flour mills.

This new reality is not just being experienced in California; it is a worldwide problem. The suggestion therefore is for "we the people" to enact legislation that will aid in the transition to localized wheat grain storage and whole wheat milling. We could ask for subsidies for whole grain mills. Another helpful change would be a *California Wheat Commission* with a new focus to aid this localization effort and drive towards whole grain flour milling.

Mill It Yourself!

MIY. Milling grains for yourself is it! All the current problems with wheat, and there are many, come down to one reality, which is that the centralized flour milling system is outdated:

Worldwide, wheat is primarily turned into refined flour devoid of bran and germ, by the now antiquated roller milling system. Only 6% of the total flour output in this vast system is whole wheat flour, which is ridiculous given the modern advice to eat our grain foods whole.

The modern solution is to buy and store our own grain, for milling into our own flour as needed, using household sized modern electrically driven stone mills. The same solution is available to bakeries, restaurants and food service kitchens as well as to large scale millers. Modern electrically driven stone and impact mills of all sizes are now available.

How can the roller milling system, which was hailed as a wonder in the 1880s be so unfortunate for wheat? It's a 140-year old story and the reality of the mistake that it was, has steadily been brought to light over the years. Here are the problems:

The roller milling method requires an initial moistening of the grain so that the bran is easily removed in the first stage, the germ is cut off the grain in the second stage, and eventually the starchy endosperm is ground into refined flour. Directly recombining the three fractions bran, germ and endosperm into a 100% whole grain flour is impossible, since the product would be too wet to store; the 100% whole wheat flour would become moldy in a very short time. Drying the bran and germ before recombining may lead to an off flavor, all apart from the inefficiency of separating and then recombining the bran, germ and endosperm. However, the refined starchy endosperm flour can be stored almost indefinitely even at 14% moisture without turning moldy. Hence the possibility of milling and storing this refined flour centrally. The result has been that refined flour production and storage is in the hands of just a few huge centralized mills that are flooding the world market with refined flour and so preventing the production of enough high-quality whole wheat flour.

Moistening the grain, which of course has been collected under farm conditions, leads to the possibility of *e.coli* contamination of the flour; dry grain does not so easily support the proliferation of *e.coli*. Dry milling would not be so vulnerable to this contamination.

The roller milling system works best with grain of a particular hardness, represented by hard red wheat. This has meant that breeders of wheat since the 1880s have developed modern varieties designed to be hard red in milling and baking characteristics, and able to grow in all kinds of climate regions. The tremendous diversity of landrace wheat appropriate in each microclimate in the Old World has been neglected in favor of this single hard red wheat type, even though it is still varied by climate region. Bakers by now, think that only hard red wheat is suitable for making bread, whereas previously breads of various textures were made with the correspondingly varied landrace wheat types, mostly in the whole grain form.

The effect of completely removing the bran and germ, is to remove practically all the minerals, vitamins, antioxidants and fiber necessary for the proper human assimilation of the starch and protein in the endosperm. Thus, eating wheat as refined endosperm flour leads to deficiency disease. Sooner or later the lack of wheat germ and bran in the diet leads to disease. In the short term the deficiency diseases are pellagra and beriberi and in the long-term cardiovascular disease, diabetes and colon cancer. Enriching refined endosperm flour with some minerals and vitamins only partially compensates for all the valuable nutrients in the bran and germ of the whole grain.

Since refined flour is practically the only form in which wheat is presented, when people realize that this flour is sickening them, their education has not allowed them to understand that the flour is endosperm only and is therefore lacking in the essential

nutrients found mostly in bran and germ. Hence the unwarranted belief that it is something *in* the flour that makes them sick rather than that the flour is actually *lacking* in nutrients. Blaming the gluten in the flour has proved to be a nonsense, although we cannot deny the existence of celiac disease and wheat protein allergies. However, avoiding all things containing refined wheat flour and instead eating other available grain foods whole, has proved healing for many people. Research shows that unless we eat *all* our basic grain foods in the whole grain form, we cannot fully realize the touted life and cost saving disease protection. It's also important to realize that even if the wheat is organic or heritage, if it is refined then it still nevertheless lacks the essential nutrients that would be present in the whole wheat.

All of this has led to a steady reduction in the demand for wheat. Wheat farmers are considerably impacted by this denigration of their crop. A natural solution will be for regional farmers to unite in the formation of businesses that *locally* provide all the services needed to take a wheat crop from seed to 100% whole wheat flour or even to 100% whole wheat baked goods. The needed local services are seed supply, planting and harvesting, grain cleaning, storage, distribution and marketing, as well as modern stone or impact milling of the grain to fresh whole grain flour according to the local demand. In any case grains and legumes need not be concentrated only in a few regions, they can be part of every organic farm rotation system aiming for healthy soil regeneration.

What's to be done? Let's ask our state governments to provide funding for the installation of modern stone and impact mills for the production of 100% whole wheat flour. We shall also need funding to educate everyone in the use of freshly milled whole wheat flour from a much wider range of wheat type than is currently available. Meanwhile we can all of us install small electric stone mills in our home, restaurant, bakery and food service kitchens and make our own 100% whole wheat flour. The result would be a drastic reduction in healthcare costs for diabetes, cardiovascular disease and colon cancer and a manageable health insurance system for all.

The color of wheat grains

One result of breeders aiming to provide the refined flour miller with hard red wheat and nothing but hard red wheat, is that these grains generally have a fairly dark colored bran color (3-brown). For the production of bran-free white flour this is not important, but if these same hard red wheat varieties are processed into whole wheat flour, the whole wheat products are quite dark in color and correspondingly more strongly flavored.

It came as a surprise to find that the color description for the hard red, Red Fife landrace and Kharkov a landrace winter wheat from Ukraine, were actually lighter (7-tan) than hard red (3-brown) and for just a few landrace wheat varieties the bran is very light colored (8-white/amber).

The actual number of landrace varieties in each color category in the USDA collection, can be seen here. Most are described as 7-tan, fewer as 3-brown and relatively few as 8-white /amber

<https://npgsweb.ars-grin.gov/gringlobal/descriptordetail.aspx?id=65016>

Originally, I was interested to correlate the bran color with likelihood of pre-harvest sprouting in summer rain after the wheat has matured. Varieties with a really dark colored bran seem to resist this tendency, whereas the really light-colored varieties are very sensitive to pre-harvest moisture and likely will sprout before harvest. Presumably wheat varieties with intermediate color will have intermediate sensitivity to pre-harvest moisture.

However, knowing the bran color description for landrace wheat varieties is also useful for the baker and chef who want to make 100% whole wheat products. It is actually possible to choose a variety to work with, according to the bran color as one of the characteristics contributing to that choice.

Grains, beans and phytates

Certainly, the phytate-degrading enzyme *phytase*, which is abundant in wheat for example but not in beans can be used to degrade phytate. Even so, acidity alone particularly at pH 4, plus heat (212°F or 100°C) will effectively decompose phytate (*D. J. Cosgrove. 1980*). Once this is learned we have an explanation for adding vinegar to beans towards the end of their cooking, and for the clear reduction in phytate in whole grain sourdough bread, which likely has a pH of 4 by the time it reaches the oven. In a well-made sourdough bread the acidity is considerable by the time the bread is baked. However, it's also good to realize that phytate plays a role when it degrades, as a source of *myo*-inositol and phosphorus, as well as the minerals that it holds before being degraded: calcium, iron and zinc. *Myo*-inositol is considered to be part of the B-vitamin complex that we need for the proper assimilation of carbohydrates. *Myo*-Inositol has been recognized as an essential nutrient to prevent diabetes especially during pregnancy.

A miller-baker wonders if there is any scientific material concerning the benefits of freshly milled flour

Yes, there is scientific material available in support of freshly milled flour having the best flavor (as measured by the amount of tasted rancidity). It is agreed that wheat germ is very oily. Once the germ has been taken out of its place in the intact whole grain, as in all kinds of wheat flour milling, the oils are exposed to air and the wheat enzymes. These oils are easily oxidized and broken down with the release of free fatty acids. The free fatty acids cause the rancid flavor and spoil loaf volume. If stone milled flour is used fresh, the amount of fat oxidation and degradation is minimized. It is also generally recognized that provided the grain was stone milled as dry as possible e.g. 10% moisture or less, oxidation and degradation of the oils is slower. If the grain is purposely dried down to say 5% moisture before milling, degradation of the oils in the produced flour is very slow indeed.

https://www.researchgate.net/publication/248587681_Hydrolytic_and_oxidative_degradation_of_lipids_during_storage_of_wholemeal_flour_Effects_of_bran_and_germ_components

https://www.researchgate.net/publication/229186789_Effect_on_baking_quality_of_changes_in_lipid_composition_during_wholemeal_storage

Some einkorn is free threshing

There is an exception in the botanical classification of einkorn. *Triticum monococcum* ssp. *sinskajae* is mostly free threshing (mostly free threshing with a relatively strong rachis) (The *rachis* is the stem running through the center of the wheat head. A strong rachis is typical of free-threshing wheat.)

<https://npgsweb.ars-grin.gov/gringlobal/accessiondetail.aspx?id=1316044>

What's in a name?

Sonora, White Sonora, Wit Wolkoring and Indian wheat

What's the difference between the wheat called *Sonora* and the wheat called *White Sonora*? The short answer is that there is no difference. *Sonora* and *White Sonora* are both names for a white-bran wheat grain housed in a beardless bronze head with hairy (pubescent) glumes. (J. Allen Clark. 1922.) The name *Sonora* was used historically in California whereas the name *White Sonora* was used outside of California in Utah, Idaho, New Mexico and Arizona.

There's more to this story. It so happens that within the landrace crop of *Sonora* there are usually some white heads. Otherwise they might be described as the same as *Sonora*. In fact, Clark describes *Indian* wheat grown in Utah in the 1800s, but of unknown origin, as a separate variety that differs from *Sonora* only in the color of the chaff (or head); the *Indian* wheat is beardless and has white pubescent chaff (or head).

Here's another observation, bearing in mind that the word *corn* is used in many English-speaking countries for the prevailing grain, and is generally *wheat*. The name for the bronze chaffed *Sonora* wheat in South Africa is *Rooi Wol Koren* (let's translate that as *Red Woolly Wheat*). Also, in South Africa the white chaffed version is *Wit Wolkoring* (or *Wit Wol Koren*, *White Woolly Wheat*). We have propagated *Wit Wolkoring* for farmer seed, in the belief that this very closely resembles the white chaffed version of *Sonora* wheat, that was previously known as *Indian* wheat.

You can find both *Sonora* wheat seed and *Wit Wolkoring* wheat seed in the Whole Grain Connection Landrace Seed Catalog of wheat seed, available in farmer amounts:

<http://wholegrainconnection.org/sitebuildercontent/sitebuilderfiles/wgclandracewheatcatalog2019notesonvarietalchoice.pdf>

The baker will notice that the bran color of *Wit Wolkoring* is even lighter in color than the *Sonora* bran. The farmer will realize that it grows very similarly to *Sonora*.

Quality control for heritage (non-proprietary) wheat

For a farmer, one of the most attractive aspects of growing non-proprietary heritage wheat varieties is the unrestricted ability to save seed from each year's crop, ready for the following year. There is considerable responsibility placed on the farmer to do this. In reality the degree of purity of a variety, cleanliness and lack of weed seeds is as essential for the production of grain ready for use as human food by the miller, and baker as it is for use as seed. The first essential is a supply of compressed air to blow out all equipment and storage units, so as to clear any residual seed after each use and likely again before the next use. To see the degree of cleanliness required in a combine harvester here's a video: <https://www.youtube.com/watch?v=8YCTcwt0kMY>

Cleaning the harvested crop of heritage wheat, usually grown organically, requires basic cleaning with a system of shaking sieves and fan to remove dust, chaff, and obviously different sized weed seeds. But for removal of similarly sized stones and seed with a somewhat different density to the wheat grain, a gravity table is required. Other specialty equipment for removing impurities in the crop includes spiral separators and indent cleaners. It is the lack of local availability of this range of crop cleaning equipment that stymies many would-be heritage grain farmers. Farmers in a region need to come together in order to make this equipment available, so as to make grain (and legume) rotation crops feasible.

Supposing these difficulties can be overcome, it is possible to have heritage wheat seed grown in California, third party verified in the *Heritage Seed Quality Assurance* program offered by the *California Crop Insurance Association* ccia.ucdavis.edu

When growing a clean and identity preserved crop of heritage grain for the first time, a farmer can begin the process of quality control with the CCIA. Actually, if the farmer has been growing a heritage grain crop for several years and has maintained a high standard of purity and cleanliness then the quality control verification can be begun at any point in time and can be continued. Continuing the quality control year after year will mean that the farmer can offer third party verified seed or food grain to their customers. Indeed, growing heritage grains successfully for seed or food demands this degree of quality control.

How to choose non-proprietary grain varieties

Basically, varieties of wheat, rye, barley and oats that are available from www.ars-grin.gov are non-proprietary. The most recent modern varieties that are listed were likely developed at least 20 years ago and have remained useful during that time. Plant variety protection (PVP), which is essentially a patenting of newly developed varieties, expires after approximately 20 years. Newer varieties may be listed at www.ars-grain.gov, but seed availability will be restricted until the PVP expires.

A farmer who wants to propagate their own seed needs to make sure that the variety they choose is indeed non-proprietary. Otherwise they risk fines and penalties payable to the developer of the variety.

Rye discussion

About growing rye in California! I have cause to pause and think again. After all, there are farmers in California successfully growing rye and pleasing their miller, baker and distillery customers. It appears that choosing between Winter and Spring habit types is crucial. Winter type rye, and that includes mixtures of both spring and Winter types such as *Abruzzi* seem only to be appropriate in the mountain and foothill regions where there is a winter snow cover. Almost everywhere else in California where the winter is mild, a purely Spring habit type seems to work well. Examples of non-proprietary Spring habit rye varieties that have pleased farmers and end users in California, include: *Gazelle*, *Fourex* and *Merced*.

If you want to grow the same variety year after year by saving and propagating your own seed, then you will need to make sure that the variety you select is non-proprietary.