

High quality wheat – local, organic and whole grain

Presented by Monica Spiller at Eco-Farm conference, January 2010

Suddenly in the twentieth century, wheat, the grain that provided basic sustenance for so much of the world, for at least six thousand years, was to blame for a wide range of health problems. Indeed wheat in the last 130 years has not been grown as it was grown in the previous millennia, and nor has the production of wheat foods, especially bread, continued as it had before.

Here's what happened to wheat in California:

After the Gold Rush of 1849, California experienced a bonanza with wheat from 1860 to 1880. On virgin soil, regularly fertilized by draught animals, sheep and cattle, and not irrigated, late fall planted wheat was a magnificent high quality and high yielding crop. This was to be expected since much of California has a Mediterranean climate with rain in a mild winter, and hot dry summers. Wheat varieties introduced from Mediterranean Spain and Portugal by the colonizers thrived, and were essentially from one broad wheat type, now designated *soft white wheat*. The bran color is very pale and barely visible in the whole wheat flour, and produces a light colored whole wheat bread. Stone milling was used as a simple one step process yielding a light colored whole wheat flour, from the soft textured grain.

The demise of wheat in California began when the Plains States were populated by the Mennonites from Russia. They brought with them *hard red wheat* that was capable of withstanding the climate of cold winters and hot humid summers. The grain is physically harder than the previously popular Californian varieties. Production and quality in the Mid-West were extremely high, again on virgin soil but beginning 20 to 30 years later than in California. Ironically, marketing was a problem, because the fashion was for white flour; stone milled *hard red wheat* flour shows the bran color and makes up into much darker colored bread than *soft white wheat*. As a result roller milling was introduced to remove the bran and germ and leave pure white endosperm flour, which is our modern *refined white flour*. California's *soft white wheat* was uneconomical as refined flour, and in any case California soils had by then been sufficiently depleted that the yield and quality were inferior. Also by this time, Californian farmers had appreciated that they could instead, more profitably grow wonderful fruit and nuts. Further degeneration of agricultural soils came with the replacement of draught animals with tractors, and the alternative use of chemically produced and imported fertilizers.

From 1880 onwards roller milled *refined white flour* was so popular that virtually the only wheat type in demand was *hard red wheat*; and this situation has continued to this very day. Quite ridiculously California, Australia, India and the Mediterranean countries with the climate that had originated wheat agriculture felt obliged to grow *hard red wheat*, and failed because it was unsuited to the climate. In the same time period, plant breeding had become very sophisticated following the acceptance of Mendel's Laws. Breeders took on the task of "improving wheat" as it was called; meaning they would make *hard red* hybrids with the *soft white* varieties. They have succeeded in this

task, but disease resistance was compromised, and the quality of the grain has often varied from the original *hard red wheat*. Every few years, hybrid varieties are replaced by newer hybrids to combat fungal disease in a particular region.

Wheat breeders changed wheat almost universally, again, in about 1950 when they introduced the trait for short stature. The goal was to make wheat varieties that could be irrigated, and highly fertilized when planted very densely and so yield very highly, without lodging. Previously, most wheat varieties planted grew to at least three feet and some to 5 feet, and if they were planted densely or in very rich irrigated soil, they would lodge.

Since then breeders have continued to bow to the refined flour millers, by breeding for hardness in *white wheat*, for the Asian noodle market and for light colored whole wheat flour. But the potential market for light colored whole wheat flour has failed to reach its potential because it has been sold as whole *white* wheat flour, and customers trying to eat a healthy diet find this confusing.

To add to this scene, bread making with refined *hard red wheat* flour is leavened with purified yeast and refined sugar, instead of the symbiotic yeast and lactic sourdough culture used in the previous millennia. *White wheat* cannot be made into good bread this way, and it has been relegated to use in short pastry, noodles, and baking powder leavened baked goods. California wheat farmers are encouraged to produce their *soft white wheat* with low protein for such products, regardless of the nutritional inferiority.

Durum wheat, also known as pasta wheat, is another Mediterranean wheat variety grown in California; it is drought tolerant and is the usually chosen wheat type in Southern California. *Durum wheat* is even harder in texture than *hard red wheat*, and has been changed relatively little by modern breeding. Landrace *durum wheat* is normally very tall. Short stature genes have been introduced into the modern varieties, so that dense planting, irrigation and high fertilizer input does not cause lodging.

California still grows wheat on about 700,000 acres, but this contributes little to the amount needed. 57% of this acreage is in *red wheat* hybrids, and half of that is used for dairy feed. Only 6% is *soft white wheat* and this leaves the state for milling. There is perhaps only one commercial mill in the entire state, devoted to organic whole grain milling and with a preference to use California grown wheat. But this is in line with the fact that only 4% of the nation's flour is whole grain. Nutritional recommendations, and the need for a localized food supply, are the antithesis of the current centralized refined flour milling and baking industries.

There is thus, an urgency to supply whole wheat products locally. Soil fertility needs to be renewed, and the quality standards that existed originally for California wheat grown on virgin soil, should be the new standards. Plus we need to pay attention to the new knowledge of fungal disease control in the field, and nutritional requirements from our grain foods.

First we can look to the landrace wheat varieties that served us before we lost soil fertility and while we were still milling whole grain flours. Landrace varieties have end use qualities that have been overlooked for too long. It is worth the effort to learn how to make products, from any chosen variety, long before bringing it to market. Indeed part of the choice will be due to the end product desired. However the more important starting point is to choose a landrace variety that comes from a similar climate. In choosing the ideal variety we also need to establish that it is resistant to local disease. This may take several seasons to discover. Landrace wheat varieties are often much larger plants than the modern varieties, and need a sparser planting. A planting rate of 50-75 pounds per acre is recommended to prevent the lodging that can occur with a dense planting. It is essential that wind can blow between the plants without resistance. The extra growth can be grazed or mowed for green chop, before there is any sign of heading up. This possibly makes for a shorter stature and increased tillering, and further reason for sparser planting. These large wheat plants likely have very large root systems. Giles Waines, who has spent his career on wheat studies, especially wheat roots will talk and give more detail, later.

Wheat is easy to grow, but not so easy to produce well. The quality most needed in the wheat grain for good bread is a protein level of 15%. This can only be achieved in a fertile soil with sufficient nitrogen and sulfur to build this protein. Sulfur can be added in the form of mineral calcium sulfate, as gypsum. Co-cropping with annual clover is recommended as a contribution to soil nitrogen and good microbial and micorrhyzae content. Annual clover is a small seeded, cover crop that can be present to advantage in all the rotations. There is a generalized organic practice to use a vetch and ryegrass mix as a cover crop, but this has proved inappropriate when wheat is in the rotation: Ed Sills is a long time organic farmer of wheat, and other grains and he has much to say later, on this topic. Ryegrass is also something to avoid since it carries several fungal diseases of wheat. Keeping ground covered with growing plants contributes greatly to carbon dioxide sequestration and of course oxygen replenishment. Constant cover crops and native plant hedgerows support wildlife and beneficial insect populations. Milt McGiffen, an expert on soil fertility, will give more detailed consideration of sustainable organic practices, appropriate for wheat in California, later.

Other important qualities are that the grain should not be discolored or damaged by fungal disease, and the grain should be dried to 10% moisture or less, which is usually a given in California's dry summer heat. The yield must be enough to give a good return on the effort to produce the crop. Variety identity must be preserved for meaningful marketing and also for the farmer to continue with a predictable crop. I recommend growing just one wheat variety on a farm, unless you have great confidence in your equipment and ability to keep the seed pure.

Fungal disease in wheat is worth making a great effort to avoid: first choose climatically appropriate and disease resistant varieties; grow them in organic well mineralized and moderately draining soil; plant in a timely manner to make use of the winter rainfall and yet head up into the hot dry season; harvest without delay but after the

grain is thoroughly ripe and dry; clean the grain immediately and store in clean bags in a dry place which is rodent and insect free; and most importantly of all, rotate the wheat out of that field for at least two years and preferably more.

To be useful as a local supply of wheat it must be completely processed and stored on the farm or nearby. Equipment is needed for planting, combine harvesting, grain cleaning (it is not clean enough for milling straight out of the field), and a place for storage must all be provided. An electrically driven stone mill can be used on the farm, to mill the grain as needed, to a whole wheat flour. Generally the mill needs a separate room, equipped to control dust.

Finally in bringing your wheat to market it will be a great advantage to have already developed some pleasing recipes, because most chefs and bakers will not have had experience with your wheat or indeed ever using wheat for whole wheat food.

Thank you.