Understanding the Small Grain Supply Chain

from Threshing through Cleaning, Storage & Milling

 A beginning farmer who grows several thousand pounds of heritage wheats or other small grains might initially assume that for every ton he or she grows, a ton of flour will inevitably emerge from the other end of the processing chain. Without anyone’s fault, negligence or ignorance, a ton of wheat seed ready to harvest in the field seldom produces more than three-quarters of its weight in flour, and far less than that if it is milled into 00 pastry flour. For “emotional” planning as much as for financial planning, it is critical that farmers, millers and bakers all share a common understanding of the small grain supply chain.

 First off, it is worth considering why a standing crop of near-mature winter or spring wheat often suffers certain losses well before it leaves the farmgate. If harvested between late May and early July (especially in the monsoonal Southwest), farmers must choose between the relative risks of two potential perils when timing the harvest. The first is harvesting the crop too early, when not all the grains have reached their full size and volume, such that it may be either too green with high moisture content, or a portion of the grains remains too small and falls through the screens along with dirt and chaff during cleaning. On the other hand, if the grain is left too long in the field before harvesting it, and summer rain storms arrive, the percent of whole plants that lodge (fall over in winds) or the amount of grain that shatters can be woefully high. As with other decisions in life, timing is everything.

Frequent sampling for moisture content, myco-toxins and shatter-ability, frequent monitoring of weather and frequent consultation with neighboring farmers and harvesters is highly recommended. Grainger and Bosworth Instruments sells Dickey-John or other brands of hand-held grain moisture meters for about $160 to $300, as do other many other agricultural supply houses; they are also built into most new models of threshers. Quart samples of clean and dry (14% moisture) grain should be taken just before and after harvest and sent to a grain quality testing service, either the University of Vermont Cereal Grain Testing Lab in Burlington, VT; the CII Laboratory Services in Kansas City, MO; or Cumberland Valley Analytical Services in Hagerstown MD. The test weight, moisture content, percent protein, falling number and the presence of “DON” mycotoxins from *Fusarium* can all be obtained for $60 to $100, including shipping. Grain with DON levels cannot exceed 1 ppm for human products, but can be used in animal feeds. Ideal protein levels for hard and soft bread wheats vary, but 12 to 14 percent protein and 12 percent moisture in the wheat berries is a typical target. The hand-held moisture meters and lab samples together cost less than $500 but may save you thousands of dollars in extra expenses or in losses.

Once reaped off the stalk and into a combine for threshing and winnowing, the grain can suffer from inefficient sorting, rolling, sieving, winnowing and other transmission losses, all of which vary greatly with the degree of shattering, lodging and mud or dirt present in the field. Losses from a poorly-timed harvests can easily be as high as half the standing crop. It is critical to keep rubber aprons and cutting bars unclogged and free of mud and debris. There can be minor transmission losses when blowing the winnowed grain into a truck for hauling, or if the bed is not fully sealed, in transport on roads. Most of these losses can be avoided by proper equipment maintenance. At this point, many organic grain growers add diatomaceous earth to their winnowed grain, to minimize losses from weevils, beetles and other post-harvest grain pests. Further drying may be necessary to reduce the proliferation of mold spores at this stage. The typical aim is to maintain moisture content of the grain below 14 percent to obtain flour with 12 percent moisture content.

When the grain arrives at a cleaning and storage facility, other losses inevitably occur. The grain is cleaned through a series of sieves or grated grills that sort it into bin; the large debris gets sorted from grain of various sizes. Unless tempered or hydrated prior to sieving, the smaller whole grains of heritage varieties such as White Sonora are easily sorted in with cracked grain, such that yield for milling can be reduced by as much as an additional 20 percent. Even with tempering the grain to a fuller kernel size, there is usually a 20 percent loss of the harvested and winnowed grain weight in the cleaning process. The cracks and undersized grain is typically bagged and can be sold for chicken scratch, but these sales are valued at only a tenth or a twentieth of the milled grain.

If not stored in a regularly fumigated, temperature-controlled room, insect pests, molds, rodents or other pests can damage the grain and reduce the saleable volume. But once it is ready to mill, the grower and miller must make choices together which affect the return on investment. If milled into 00 pastry flour, the weight of the wheat berries is reduced to 50 to 65% of their original weight, as bran and midlings are sifted away, but the value per pound in the marketplace can double to compensate for these losses. If milled into all-purpose flour, about 70 to 75 percent of the original weight of the wheat berries is retained. The bran, and to a lesser extent, the midlings, sorted out from the final flour product can be used in a variety of ways, but retain less monetary value.

For further information download Bulletin #1019 for the University of Maine Extension Service, Understanding Wheat Quality by Mallory, Bramble, Williams and Amarai (2012): extensionpubs.umext.maine.edu