LETTER FROM NEW YORK

Smoothing the path to a profitable harvest home

Dozens of harvest tips to ensure that your good grain isn't transformed into the bad and ugly by poorly maintained equipment, improper storage or rough handling.

By Mary-Howell Martens (with Klaas' help)

Farm-at-a-Glance

The Martens' Farm

Location: about 60 miles southeast of Rochester, NY, on the western shore of Seneca Lake
Important people: Klaas and Mary-Howell Martens, Peter, Elizabeth, and Daniel. Plus Robert Hall (employee/asst farm manager)
Years farming: We've farmed this farm together since 1991. Klaas has farmed all his life.
Total acreage: 1500
Tillable acres: 1300
Soil type: Honeoye Lima silt loam
Crops: corn, soybeans, spelt, wheat, barley, oats, triticale, red kidney beans, sweet corn, snap beans, cabbage, edamame soybeans
Livestock: sheep, pigs, chickens for our own use
Regenerative farm practices: diverse long term crop rotations that incorporate legumes and small grains, under seeding all small grains with red clover, actively increasing soil organic matter
Marketing: corn & small grains are sold to Lakeview Organic Grain LLC, our organic feed business.

Posted September 28, 2004. Standing out in your field, surrounded by those amber waves of grain or rustling corn stalks, it is hard to imagine that the value of that beautiful grain could be spoiled by mishandling during harvest, transport, and storage. Unfortunately, growing the crop is only half the battle, though it is the part that farmers tend to focus on most . Now comes the second half of the challenge -- maintaining that fine grain quality until sale.

Several years ago, the plant manager of a soybean cleaning facility spoke to our group of organic farmers about soybean quality. At the front table, he brought out samples of soybeans that he had received that year, samples that he called ‘the good, the bad, and the silly’. Moving down the table, he held up the jars for all to see, graphically describing the samples of food-grade soybeans, damaged by harvesting equipment, improper storage moisture, rough handling, inadequate storage conditions, and weed staining. It was indeed a rogues’ gallery of avoidable mistakes.

The farmers edged closer cautiously, half hoping, half dreading that Skip would name names, preparing to be proud, or embarrassed, or carefully indifferent. But the truth was, they hadn’t the slightest idea which of the samples were theirs nor which category their beans had fallen into.

Now it is harvest time again. Throughout the United States, this has been a difficult and stressful season, and many farmers and crops are eager for this year to be finished. At our feed mill, we now are in the role of buying grain from many Northeast organic farmers. This year, we’re are seeing some truly beautiful organic

Soybeans, red kidney beans, and spelt sold to brokers and processors. Some spelt is sold as kosher organic spelt. Sweet corn, snap beans and edamame are sold to processors who freeze them under brand name labels. Cabbage is made into sauerkraut and packed under the Cascadian Farms label. Some of the oats, wheat and barley are being grown from Foundation Seed to produce Certified Organic Certified Seed.

For the story of the Martens' transition to organic, check out **How Mary-Howell and Klaas Martens made the transition to organic.**

WHAT WE WISH FARMERS WOULD THINK ABOUT!

Each season at our mill, we receive many loads of grain from different sources with widely varying quality. Daniel Hoover dries, cleans and conditions the grain, storing it often for months, and then, through a pretty amazing alchemy, is able to turn all those different loads of grain into high quality, fairly consistent animal feed that is worth the organic premium price.

Since Daniel is the one coping with this grain as it comes from the field and the grain, heavy, bright, and clean, and we are seeing plenty that is salvageable with careful drying and cleaning. Unfortunately, there are definitely a few loads that are not worth saving. Being organic alone is not enough to redeem some of the stuff we've seen!

Right now, our lives seem to revolve around organic grain – planting, growing, harvesting, buying, unloading, storing, grinding, selling, shipping, cleaning up. Daniel Hoover, our feed mill manager, figures he has seen every type of grain grown in New York in all different states of disrepair. That's a pretty wide range!

Perhaps with a little preparation, the number of really good grain deliveries will increase, not only to our mill, but also to wherever you sell your grain!

PREPARING FOR THE HARVEST

It starts well before the grain is ready to harvest. We organic farmers can't go in and spray if weeds and insects get away from us in the field, and we can't use chemo-therapy to control insects, rodents or mold in storage. As in the field, our only real control of such problems is to prevent them before they begin.

All equipment, combines, augers, trucks, wagons and bins, should be cleaned prior to harvest to remove any old grain that could be a source of mold and insects. Cleaning out bins is not pleasant, we know! It is hard to find the time to get into the bin to shovel, sweep, vacuum, and perhaps even scrape and hose down. It is hot, uncomfortable, dull work that feels very unproductive. But you should **never** put new, clean, insect-free grain into a bin on top of old grain or debris. If the old grain was infested, the problem will spread upward into the new grain and extensive damage may occur before it is apparent at the surface.

Don't just dump the cleanout on the ground outside the bin. All the old grain should be removed from the area so populations of insects do not migrate back into the newly filled bin. This is particularly important with summer-harvested small grains because it is a long time before cold winter temperatures will slow down mold and insect growth. Clean around the bins too, removing high grass, weeds, spilled grain, and debris that attracts insects, rodents, woodchucks and other undesirable wildlife.

While cleaning, check that the bins are tight, with no cracks or leaks. Check sides and roof for leaks, corrosion and broken bolts ... and repair and replace damaged areas, especially if they will allow moisture, insects and rodents to enter the bins. Make sure the unloading augers, fans and aerators work before filling the bin! Some farmers suggest putting a light inside the empty bin at night to better see leaky areas. Caulk and repair damaged areas.

If you are not using dedicated organic harvesting and handling equipment, your certifier will expect you to maintain a cleanout log, showing that the equipment was thoroughly cleaned and purged of conventional grain before any organic grain was introduced. This is particularly critical with custom hired equipment which is likely to also be used to harvest Bt corn and Roundup Ready soybeans. You do NOT want those grains contaminating your organic grain!

bins, I asked him to describe a few things that he wishes farmers would think more about as they harvest :

1. Prepare the destination of the grain before you start harvesting. If you are delivering the grain to the buyer directly out of the field, be sure you let them know when it is coming before you start harvesting and give them an accurate, HONEST assessment of grain moisture, cleanliness and condition. It may not seem like a big deal to tell your buyer the grain is 14% moisture when it is really 14.9 %, or that there are 'a few weeds' in it when it is really quite dirty, but it might make an enormous difference in labor and time demands, dryer usage, and cleaning requirements once the grain is delivered. If you find mold, insects, or other problems when you start unloading a bin, let your buyer knows before delivery. Selling one quality and delivering something different is not good for anyone!

2. Get a good moisture meter and calibrate it carefully. Learn how to read and interpret samples accurately and honestly for % moisture with appropriate temperature calibrations. Check moisture often as you harvest. Far too much grain goes into farm bins that is not at a proper moisture level for successful storage and then comes out in poor condition.

3. Clean before drying. If the grain is above about 2% foreign matter, especially with weeds and other plant debris, run it through a rotary cleaner before drying and/or storing. Grain dryers can catch fire if there are weeds and chaff in the grain, and debris mixed with the grain

HARVESTING CRITICALLY

Our inputs of seed, land, labor, equipment, fertilizer, tiling, irrigation etc, combined with whatever the weather brings, results in a mature crop (we hope!). But, once grain reaches physiological maturity, that is as good as the grain is going to get. If the grain stays out in the field past physiological maturity, there will be a steady decline in quality, test weight, yield, and, for small grains, the increasing possibility of sprouting. Waiting for the crop to reach optimal storage moisture in the field before beginning to harvest can result in yield loss and in a major loss of quality if rain or snow delay harvest. It is better to dry good quality grain at the beginning of harvest than to have to dry damaged grain at the end of harvest.

Older, well-worn combines are very common on many organic farms. While older combines can do a good job, they will not perform adequately unless they are very well maintained,. There is absolutely no substitute for a well-adjusted combine in good repair, with the knives, guards, raspbars, and concave replaced when needed, and with all parts straight and in good condition so the grain will feed in evenly, quickly and with minimal damage.

Rasp bars and concaves can be worn-out long before they appear to be. Worn auger flighting reduces capacity and cuts seed coats. For some crops like barley and grass seed, fillers should be installed in the concave to do an optimal job. It is best to keep the combine running at full capacity to prevent grain from rubbing against iron. Select a ground speed that will not overload combine or overrun the header's capabilities, but is fast enough to keep moving material in.

Iowa State engineers found that poorly adjusted combines can do far more damage than generally thought. At common combine settings, an average of 30% corn kernels can be damaged. Much of this damage is not apparent in the field or in wet grain, but will lead to grain breakage during drying and can result in increased shrink, insect and mold damage during storage. Most combine operators over-thresh grain, damaging the grain and increasing the amount of fines. The percent damage rises dramatically when the threshing mechanism or cylinder are run too fast. Most operators' manuals list suggested optimal settings for each type of grain. Use these suggestions as a good starting place for making the right adjustment to maintain grain quality and machinery life. (for more details about the Iowa State research on combine adjustments and operation, click here.

Remember that crop conditions can change not only by the field but also by the hour as weather conditions and moisture content change. Peter Shuster, an organic soybean processor in New York, cautions that dew early in the morning can cause dust to stick to food-grade soybeans and stain them. It is critical to wait until after the soybean plants dry completely to begin combining, maybe until after lunch. After you combine a few hundred feet into a field, running the combine at full capacity, stop and look critically at the thrashed beans. If they do not look clean and bright, stop and wait until conditions are better

MYCOTOXIN ALERT!

brings down quality critically.

Steps to Minimize Mycotoxin levels

1. Always use cleaned, high quality seed that is not carrying seed-borne diseases. Even if the seed-borne diseases themselves do not produce mycotoxins, they can weaken the plant and damage the grain, which then can lead to infection with mycotoxin-causing fungi.

2. Harvest at maturity and as soon as the moisture content allows minimum grain damage. This means harvesting shelled corn at 23 - 25 % moisture, ear corn at 25 - 30 %, small grains at 12 - 17%, and soybeans at 11 - 15%.

3. Adjust the harvesting equipment for minimum grain damage and maximum cleaning. Especially where scab is evident in the field, the combine should be set for maximum cleaning, with higher blower speeds to remove the small shriveled diseased kernels.

4. Dry suspected grain to at least 14% moisture as rapidly as possible, at least within 24 - 48 hours after harvest. Safe, long-term storage can be achieved at a moisture level of 13 percent or below.

5. Cool the grain after drying and maintain dry storage conditions. Sometimes it may be necessary to clean the dried grain through a rotary cleaner to remove broken and diseased kernels and fines, but do not feed the screenings to animals.

6. Thoroughly clean all bins before storage to remove dirt, dust, and old grain that may be contaminated. Store in water-, insect-, and rodent-tight structures. Keep grain well-aerated and monitor regularly.

7. If you have good reason to suspect mycotoxin problems, contact a forage testing lab and have the grain tested for

mycotoxins before feeding it or representing it to a buyer as high quality, clean grain.

Mycotoxins are produced by certain types of fungi that grow on maturing plant material, especially grains. These can cause health problems for animals that eat the contaminated grain, silage, baleage, hay, high moisture corn etc. Wet, rainy, warm, and humid weather can promote mycotoxin-causing fungi that grow on corn and small grains. Infection with mycotoxins is most common on grains damaged by insects, birds, mites, hail, early frost, heat and drought stress, windstorms, and other unfavorable weather. Mycotoxins can also form when grains and forages are harvested and stored at undesirably high moisture levels, if grains go into storage dirty, or if storage facilities leak.

Experts estimate there are over 300 fungal toxins that can form on crops, but there are several that are distressingly common. Several species of the common soil fungus, Fusarium, can result in ear-rot in corn and scab or head blight in wheat, barley, oats, and rye and can produce vomitoxin, fuminosin, and zearalenone. Several species of the fungus Aspergillus, also a common soil fungi, can commonly cause stored grains to heat and decay and produce aflatoxins.

It is not easy to tell whether grains contain mycotoxins. There are accurate lab tests available, but these are expensive and are usually not done unless there is good reason to suspect a problem. Aflatoxins can be tested for with black light, but often the presence of Fusarium toxins are not noticed until after there is an adverse reaction from feeding contaminated grain to animals. Mycotoxins make the grain unpalatable, can cause reproductive problems in animals due to estrogenic activity, and can even be toxic.

BEFORE GRAIN GOES INTO STORAGE

Inspect the grain critically. If there are weed seeds, weed debris, chaff or non-grain material, clean the grain before putting it into the bins. A rotary cleaner before the dryer or bin is usually sufficient.

Studies have shown that the moisture level of the grain going into storage is key to successful storage. See the chart below for the maximum grain moisture needed for successful storage. Note that this percentage refers to the highest moistures in the bin, not the average moisture. As little as 0.5 percent moisture can mean the difference between safe storage and a damaging invasion by storage fungi.

MAX GRAIN MOISTURE FOR AERATED GRAIN STORAGE

Grain Type	<6 months	6-12 months	> 12 months
Shelled Corn	15	14	13
Soybeans	14	12	11
Wheat	14	13	12

For lesser quality grain, such as grain produced under drought or moisture stress or with a large amount of damaged or immature kernels, the recommended maximum moisture levels should be at

least 1 percent lower.

For most farmers, drying the crop is the major bottleneck in the harvest process. Too often the combine must wait for the drying to catch up, and the grain dryer is the major limiting factor in harvest speed. Sometimes it is tempting to try to hurry the drying process by increasing the temperature. It is important to monitor the temperature carefully when drying with heat. Excessive heat can break down protein, oils and starches, reduce germination, and can result in cracks and damage that will increase storage insect and mold problems. With as little as five minutes exposure to high heat, it is possible to cause 100% of the soybeans to crack. Excessive heat, especially if the dryer stirring mechanism is faulty, can also cause dryer and barn fires.

In the bin, it is important that the headspace air is sufficiently ventilated. If you pack a bin to the roof, water condensing on the inside of the roof where the grain touches will likely result in mold which can spread downward through the grain. Warm, moist headspace air can activate mold growth, causing grain to crust and seal over, especially when grain is peaked. Mold can spread over kernel surfaces and results in caking near the surface in about three weeks The mold produces CO_2, water and heat, raising the humidity and causing further mold growth. Crusting and caking is not just a grain quality problem, the chunks can get stuck in augers making unloading the bin really difficult.

DON’T LEAVE IT ALONE!

Aeration in the bin is a very good way to maintain a seasonally cool and fairly uniform grain temperature. During the fall, aeration is necessary to remove dryer heat and equalize moisture levels throughout the grain. During the winter, operate the fans only when the air temperature is the same or colder than the grain. Operating fans on warm winter days can cause moisture to condense on the cold grain. If grain is stored into the following summer, run fans only at night when the temperature is fairly cool. Remember that proper aeration also requires proper ventilation so make sure there are no obstructions for air movement through the grain.

The chance of grain becoming insect-infested or moldy increases when it is left undisturbed for several months. A regular monthly inspection routine throughout the grain storage time is important. especially during the summer and early fall months when grain temperatures are right for rapid insect and mold development. It is a good idea to routinely take a load out within a month of filling the bin to equalize moisture and break up any crusting.

During warm weather, insect infestations generally begin near the grain surface, especially directly 6 -12 inches below the grain surface, especially at the point of entry where dust, broken kernels and chaff accumulated during filling. Walk out onto the grain - your feet should sink in slightly, If the grain feels hard, this could indicate caking. Smell the grain for mold, look for insects, stick your hand down into it at least 10 inches to check for heating and caking. If you catch grain just as it is starting to “go”, sometimes just moving several loads out of the bin will redistribute the moisture enough to stop further deterioration.

Our friend, Chuck Richtmyer, who is also the seed manager at our feed mill and a long-time farmer, sticks a wooden shovel handle into grain. Periodically he pulls it out and feels the end to detect any heating as an early and simple indication of trouble. Probe thermometers work too, but a shovel handle is always available.

Check more frequently the next spring and summer as grain warms up. If grain is frozen during the winter, it may be necessary to warm the grain up evenly in the spring with aeration to prevent condensation on edges and top. Operating fans continuously when thawing frozen grain will prevent refreezing on condensed moisture and will prevent damp spots.

WHEN THE WEATHER MAKES IT DIFFICULT TO DO THINGS 'RIGHT' ...

These past two years of incessant rain have pushed our equipment, our knowledge, and our skills to new limits. Once upon a time, we thought it was impossible to have 5 straight months of humidity too high to dry anything. Now we know better! It can happen and it makes grain storage much more challenging. Here are a few things that we have learned.

1. Equilibrium moisture -- temperature and relative humidity (RH) of the air -- plays a major role in grain storage. Stored at a given temperature and RH, grain will naturally hold certain amount of moisture. For example, at 50° F, soybeans will equilibrate to 9.5% moisture at 50% relative humidity. But, at the same temperature, soybeans will equilibrate at 13.2% moisture at 70% RH and will equilibrate at 19.4% at 90% RH. Raising the air temperature or increasing air pressure around the grain will increase the amount of moisture that the grain releases into the passing air. Charts are available that show grain equilibrium moisture for different crops, temperatures and relative humidities. These are valuable to predict whether aeration alone will be effective under given conditions. Generally air drying in the fall can work well, as long as the relative humidity is low, but trying to achieve air drying under typical Northeast summer or moist fall conditions will be much less successful.

2. When the humidity is continually too high to run the bin fans without having the grain gain moisture, we set a small LP gas heater or camp stove in front of the fan to warm the air just a few degrees. This isn't enough to warm the grain, but it lowers the humidity of the air drawn in by the fan enough to dry the grain slightly.

3. Using relatively hot (more than 10° over ambient temperature) air to dry stationary grain creates a 'drying front' in the bin where a layer of wet grain forms as moisture is pushed up through the grain. The grain below this layer is often overdried while the grain at the top of the bin doesn't lose any moisture or may even get a wetter for a while. When the front finally gets all the way to the top, the grain at the top can suddenly go from being too wet to being way too dry!

4. Wet grain that is in bins for too long without being moved can develop hot spots that begin heating and molding. Even with a perforated floor and a fan running, these spots continue to heat

and spoil because the forced air goes around, rather than through, the grain. Moving such grain out of one bin and into another breaks up hot spots and prevents them from spoiling.

5. Grain stored in a wooden bin or touching wood will keep longer than grain stored in metal. Some farmers will even stick wooden fence posts into wet grain in the bins to keep it from spoiling – amazing, but it helps!

AS THIS !*%$! SEASON WINDS DOWN . . .

Studies show that most consumers who purchase organic products do so primarily because they perceive organic food to be of higher quality and nutritional value. This may or may not always be true. However, it is absolutely imperative that organic farmers focus on producing and maintaining high quality organic products to the very best of our ability – that is unequivocably our responsibility. The days of organic crops selling easily simply because they are 'organic,' regardless of quality, are over and this is as true for organic wheat as it is for organic tomatoes.

As organic farmers and processors, we have a serious and challenging responsibility to make sure that the perception and the reality are as similar as we can possibly make them. It does matter.