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Harvesting, Drying and Storing Blighted Corn

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GENERAL SITUATION AND RECOMMENDATIONS

Stalk rot and cob rot in heavily blighted corn is generally severe, and the stalk and cob rot develop exceptionally fast. In addition, lodging is potentially very severe.

It seems likely that heavy foliage from rain or snow, accompanied by wind could lay some fields almost flat. Stalk rot appears so severe in some fields that it seems likely that many stalks may break off before or during harvesting, causing excessive loss and clogging.

The stalk and cob rots are also present in the ear shank, so ears in some fields will drop readily before or during harvest. The cob rots also destroy the central core of the cob. In advanced cases cobs are spongy or rubbery when twisted or flexed, and can be easily crushed by squeezing. The rotted cob simply has no crushing strength, and will not withstand the pressures necessary for shelling. It will shatter and go through the cylinder without complete shelling.

A number of secondary ear molds are present on the corn kernels and exposed cob surfaces in the field in addition to the fungus Helminthosporium maydis, that causes the original disease. These molds will tend to stabilize and stop growing when kernel moisture content reaches 25 percent to 21 percent in the field accompanied by lower fall temperatures. Bear in mind that cob moisture contents can still be higher when the kernels have dried to this level.

At regular intervals farmers should observe their fields closely to gain a good estimate of the rate of development of these factors. Observations should be made within the field away from the outside rows. Outside rows develop and dry differently because of their increased access to light and air. To gain an estimate of percent stalk rot present pinch stalks near the ground and up toward the ear for a distance down the row.

A hollow shell that collapses easily indicates advanced rot. Pull ears that are representative of the different field conditions and flex, twist, and break cobs to look for rot. Squeeze the ears to test crushing strength which will help indicate when to start the harvest to minimize losses. Note dropped ears and shake stalks to estimate stalk rot/ear drop.
Early harvest is the best general recommendation if the problems of handling and storing such corn can be met. Many farmers anticipate an early harvest, but it appears that many are not planning to advance operations as much as the conditions in some fields would seem to warrant. Corn can be combined at moisture contents of 30-35 percent. Kernel damage will probably be increased, but this may be less important than the losses from lodging or ear rot if these are present and developing fast.

It would seem wise to make test shellings in a critical field to determine whether harvesting should be delayed for more field drying. The test shellings not only furnish experience on how the corn will shell, but also help check out the equipment/manpower system. A test will also call attention to any special machine adjustments, operating procedures, or equipment repairs that may be necessary; and will polish up the gathering snouts, chains, rolls, and grain conveyors for better operation when conditions are right for continuous harvest.

Farmers should be cautioned against adopting a "panic" program or practice for which they are not prepared with either equipment or skills. A man who has not, for instance, been making silage or feeding cattle may be ill-advised to adopt such an emergency program this year. Cattle feeders unskilled in buying and selling and in using temporary silos and makeshift facilities are vulnerable to serious losses.

**HARVESTING FOR SILAGE**

**Corn Silage.** Both corn silage and high moisture shelled corn or corn-and-cob meal can apparently be made satisfactorily from blighted corn.

The only limitation appears to be in ensiling materials that are in advanced state of decomposition in the field. The latter is difficult to define, but in the words attributed to one Georgia farmer with experience, "If you put in rotten material, it looks like you get rotten material out." He had filled four 400-ton silos in succession, over a 3-4 week period. The last silo went out of condition in his as well as a number of similar cases. In all these cases the material that went into silos was dead and rotting badly at harvest. Those affected noted, however, that their corn died in ten days from initial infection under their conditions, and harvest did not begin until they realized that silage was the only way they could salvage some of the material.

The same practices that apply to ensiling mature corn silage would seem applicable to blighted corn. Water can be added to increase moisture content, but should be used with caution -- fermentation is not totally determined by moisture content but also depends on sugars available. Information on expected yields from mature and immature corn silage is available from the county Extension office or the Purdue Agronomy Department.

Consideration might be given to harvesting corn silage from one field and ear or shelled corn from another, and combining the two to make a complete feed, except for a protein supplement. The extra corn can substitute for the lack of grain in very immature corn stover. Or, the corn normally fed with silage can simply be stored in the silo this year. This permits earlier harvest of the grain, and also adds sugars and starches for the fermentation process.

It would not be wise to mix ear corn or shelled corn with silage stover that was in very bad condition, considering the risk that both might be lost.

Shelled corn from a combine should preferably be ground or at least cracked when added to silage. Grinding improves the pack and aids the animal's assimilation.
of the grain. Ear corn should be ground (preferred) or finely chopped.

**Grain Silage.** Either shelled corn or corn and cob meal can be ensiled alone. Moisture contents would ideally be in the 22-25 percent range, especially for shelled corn for hogs. Moisture contents can run up to 30 percent or more if necessary to salvage the material.

Whole shelled corn can be stored in sealed silos. For non-sealed silos (upright) with a roof, the materials should be ground. Grinding improves the pack and reduces oxygen by preventing the movement of air through the mass. To reduce spoilage the top surface should be sealed with plastic.

Horizontal silos may also be used. In this case ground materials are essential. Getting the material into storage as fast as possible to minimize heating is more important than packing. The silo should be filled and covered with a plastic seal as expeditiously as possible. Moisture contents are the same as those for uprights.

**HARVESTING FOR GRAIN**

**Ear Versus Shelled Corn.** The safest storage for dry grain is probably shelled corn dried uniformly to 12-13 percent and maintained at this moisture content. Mold organisms will generally be inactive at these moisture contents. The lower than normal (13-14 percent) recommended moisture content will help offset problems from increased fines, residue from rotted kernels, chaffy grains, etc.

**Ear Corn Storage and Handling.** Ear corn storage is somewhat more difficult to assess. As mentioned earlier, it is anticipated that the mold development on the ear standing in the field will slow or stop when moisture contents reach the 25-21 percent range. However, if the ear corn is then harvested and cribbed, molds will continue to grow in storage at the higher moistures of this range until freezing temperatures occur. A kernel moisture of 18 percent should stop growth of *H. maydis* and almost all storage molds.

The alternatives for ear corn handling are not the most desirable. The grain might be left in the field until moisture content drops to at least 21 percent. But, this runs the risk of grossly increased lodging, continued rotting of ears, and ear drop losses. However, delayed harvest has an advantage in that day and night temperatures will be lower and will reduce biological activity in the crib, and give greater assurance that the 21 percent or lower moisture content ears will store without further damage. But, on the other hand, there is also the possibility that little more drying would occur in the field, or that the combination of down ears (soggy and moldy) and dry ears may not store any better.

Both unheated and heated air drying of ear corn might be considered. Unheated air drying will usually not result in moisture contents below 18 percent in the fall. However, an earlier harvest in warmer weather this fall might give an increased drying capability, both in drying speed and final moisture content.

Heated air drying presents problems of fire risk around shucks, cobs and silk residue, plus finding or adapting equipment. Shelled corn drying equipment can be adapted, although the fan designed for shelled corn is not the most desirable for ear corn (it is designed to deliver air at a higher static pressure than equipment for ear corn), but it will work. However, fans designed for hay drying or ear corn are most desirable.

Both unheated and heated ear corn drying involves the installation of a suitable duct along or inside the crib. The duct must contain sufficient area to carry the necessary air, and it must distribute the air uniformly.
through the grain mass. In general, ear corn depths for drying can be 8'-12' around, beside, and/or over the duct. Corn depths can be as much as 16'-20' with special fan designs.

It requires roughly one fan hp. for each 800 to 1000 bushels of ear corn, with the amount of corn lowered as moisture content rises. A one hp fan will deliver roughly 3000 cfm at 1" static pressure (about equivalent to static pressure of 12" of corn). Air velocities in the duct should not exceed 1500 feet per minute. This means the duct must contain two square feet for each fan horsepower required. **Note that a shelling trench is not adequate for more than about one hp.** See USDAMP 919 -- "Drying Ear Corn by Mechanical Ventilation" for illustrations and installation details.

It may be advisable to force dry ear corn, shell immediately and then either market the grain or complete drying and store as shelled corn in the 12-13 percent range.

**Harvest Machine Adjustment and Operation.** The first and most specific recommendation on harvesting down corn is to slow down. A ground speed of two mph is usually about right. Gathering chain speeds and roll velocity should be correspondingly reduced to maintain the normal relationship with ground speed. Snapping should occur about one-third of the roll from the top. Look at the rolls after you have harvested some time, and note the location of the bright, polished area where snapping occurs. If this area is too far forward, the bright area will be down low on the roll. Snapped ears may be pushed into the rolls by incoming ears, causing shelling. Any stalks that are whipped as they are drawn in may pitch the ear out over the snouts where it won't be picked up. If the snapping area is too high, there is too little roll length available to handle trash or temporary overloads.

With rolls and gathering chains running too fast, the stalks may be broken or ears lost as they are yanked into the machine before the snouts are under the plant to act as a "catcher's mitt." With the severe stalk rot of blighted corn, mis-handling of the stalk may break it off, causing clogging or complete loss.

Obviously, picker or combine snouts and gathering chains should be run as closely to the ground as possible to pick up downed corn. Corn pickers will frequently do a better job than combines in severely down corn primarily because most pickers have two sets of gathering chains, and the lower chain sometimes almost runs in the dirt. It will pick up stones or rocks but these do not generally bother pickers. This is the primary reason the lower chains are left off combines, however, since stones and combine cylinders do not mix well.

Several Southern Indiana farmers who have harvested in heavy stalk rot conditions indicate that they had to adjust gathering chains and rolls inward as closely as possible, to adequately grip the stalks with no center core. These stalks collapse to a thickness of approximately 1/8" when squeezed. Some manufacturers further suggest that it may be desirable to adjust the front end of the snapping bars or plates slightly closer than the heel. This helps avoid the tendency to jam or wedge in the snapping area, so the trash and ears can move into the machine.

Arc-welded beads are sometimes applied to corn picker rolls to increase aggressiveness in trashy conditions.

Rubber flaps can also be bolted to one snapping roll. Coarse sand can also be bonded to one roll by epoxy resin to increase friction, as is done by one manufacturer.
Husking small ears with long husks is difficult, particularly if the husk tips are stuck together by rot. Extra roughness may be necessary on metal husking rolls. Some pickers have provision for inserting lugs or spring hooks to grasp the husks better. Some such expedient may be needed particularly at the bottoms of the husking rolls where long-tipped nubbins tend to be turned up vertically and accumulate, clogging the husking bed.

On combines, the installation of filler plates between the concave bars should be considered to better shell the small ears and pieces that are prevalent this year. Cylinder/concave clearance should generally be reduced and the cylinder speed increased to aid in shelling the pieces of cob and corn from the rotten cob. Reducing the clearance and speeding the cylinder will tend to grind the cob into smaller pieces, and more cob should be anticipated in the bin. Increasing cylinder speed also tends to damage more kernels, so it should be as low as possible to get the best total job.

Under the above shelling adjustment conditions, the air on the combine should be set as high as possible and still hold the grain. Some manufacturers offer special corn chaffers and shoes to aid machine performance in such conditions. Some manufacturers also offer extra baffles for installation on the trough sides of the snout surfaces to reduce ear loss under adverse conditions.

Drying Shelled Corn. All of the commonly used methods of drying grain, involving both bin and flow-through methods should work satisfactorily in the grain conditions from blighted corn. The grain will probably contain more fines, more trash, more rotten and moldy kernel refuse, and a higher initial moisture content. This means, in general, that it will not flow so readily or well, will impede air flow, will not look or grade so well before or after drying, and will probably take longer to dry each bushel. Remember, however, that you may have fewer bushels to dry, and may be drying them earlier in the season with more favorable drying conditions to start with.

Bin Dryers. For in-bin drying processes, the use of shallower grain depths should be considered. This will help compensate for higher initial moistures and more fines, which reduce air flow. Even distribution of fines into the bin will be even more important than normal. The addition of grain stirring equipment, especially where the existing bin is too small to give adequate drying capacity even under good conditions, may be an especially wise decision this year.

Although there are still apparently some mechanical reliability and overall performance problems with stirring devices, recent farmer experience is generally quite favorable. This is especially true where stirring increased the output of an existing bin dryer to meet the needs of the farm.

On new bins, it still seems logical to size the bin and fan-heater to meet the current drying needs of the farm, and then consider adding stirring or blending equipment to further increase capacity. Thus, if the mechanical system is not satisfactory, the bin has an adequate basic capacity.

In up-rating existing 18' to 24' or 27' diameter bins, the fan and burner must have sufficient output to capitalize on the increased grain exposure for drying that the stirrer or blender can give. In general, this means the burner should be capable of heating the air delivered by the fan to 120°F - 140°F. Frequently, the existing burner is not large enough to do this. On the other hand, it may be old enough that it has paid out and a change to a modern, higher rated unit would be warranted.
In considering new burners for existing bins, it is advisable and frequently necessary to change both fan and burner. Many late model units are built with fan and heater in one housing, not available as separates. Too, match-up of components both in size and controls is important for safe and satisfactory performance.

When changing fan-heaters on an existing bin with grain stirring or blending equipment in the bin, consider increasing the fan size to the next larger unit available. Thus, an 18' diameter bin might go from 3-5 hp, up to 5 or 7 1/2 hp. Similarly, a 24' diameter bin originally equipped with a 7 1/2 hp unit, might be increased to 10, 12 1/2, or even to 15 hp. Be aware that doubling the horsepower will not double the drying capacity, but will result in a sizable increase. Recognize too, that a single increase in horsepower will probably give the greatest response - to add four times the horsepower, for instance, may give little over that of a unit 1 1/2 or twice the original size. The big unit on a bin too small is not efficient and simply wastes power and energy.

It should also be noted that it will be necessary to change the air entrance transition and opening into the bin if the air flow is increased appreciably. Check this with the manufacturer of the new fan.

Grain Cleaning. Grain cleaning on both the input and output side of the drying process might be considered when excessive fines are evident. Wet side cleaning never works well. The fine materials do not separate easily or completely. The wet fines present problems in storage and handling unless they can be fed immediately. Such input cleaning probably has more advantages in a deep layer bin drying process, since the grain is not removed for storage.

Cleaning on the output side of the dryer, before the grain goes to final storage, is advisable only where fines are excessive.

In the last several years, following the bad experience with the 1967 corn crop, many farmers have cleaned indiscriminately and unnecessarily. The material screened simply resulted in a weight loss with no grade premium for the finished grain.

A simple grain cleaner using an outside frame roughly 24"-30" wide and 6'-12' long, with a hardware cloth bottom can be built. The frame is inclined at an angle that will cause grain to tumble down the incline, with the fines dropping through the screen. A 1/4" mesh is generally used, but the small kernels or excessive broken large pieces of kernels that may result from the blighted corn, may require a smaller mesh.

Batch and Continuous Dryers. Reduced air flow, increased moisture content, and flow problems are potential problems in flow-through dryers. Poor flow can result in a pocket of grain or refuse material "hanging up" in the dryer and ultimately causing trouble. Such non-flow can be checked in batch dryers, since they unload frequently, but continuous flow units may not be cleared except at the end of the season. Since continued non-flow and/or refuse accumulation in an area of the dryer can increase the likelihood of fire, the dryer should be inspected carefully, the interval depending on past history and the operating conditions at the moment.

Storage of Dry Shelled Grain. More fines, trash, and residue from moldy and rotten grain means more risky storage. Grain that is excessively damaged or chaffy should not be considered for any appreciable storage period if it is not essential. Shelled grain is a living product that is subject to biological/chemical changes if not managed correctly. Good grain under correct management can be stored for years and hold quality, but grain of initially poor quality will require superior management to maintain even short term satisfactory storage. The risk is simply greater than it would be under normal conditions.
No storage problem is expected from the mold activity of *H. maydis* at dry grain moisture contents low enough for long term storage, since the mold will be dormant at these conditions. There is a remote chance that there could be some biological/chemical changes in the grain, as a delayed result of an earlier mold infection in the field, that could result in further grain quality loss in storage. As of the moment, there is no basis to expect such a change, except to note that some earlier work on wheat a number of years ago indicated such a possible change.

Farmers and elevator operators are advised to observe grain more frequently when initial quality is low. Probing and observation on at least weekly intervals would seem advisable, especially when going into the colder winter season. Damage estimates periodically might be in order too as a benchmark on quality deterioration.

If the initial quality is poorer than usual, it is advisable to dry the grain to slightly lower moisture – to 12-13 percent as opposed to 13-14 percent – for safe, long term storage (4–8 months, into the summer). It is quite probable that grain for short term storage to be marketed shortly after the harvest period, can be stored at moisture contents up to 15 1/2 percent. The success or failure would seem to depend on the grain condition and temperature. If the condition is good and the grain and air temperatures cool or are cold, the chance of success is greatest. If grain quality is poor, with much damage and fines, and it is harvested and initially stored in a warm weather period, management is critical.

Storage of shelled corn at moisture contents above 15 1/2 percent, with or without aeration, is not advised, especially when grain and day/night temperatures are relatively high. With good corn quality, moisture contents below 22 percent and early November weather, storage with 1/2 cfm/bu or more aeration may be workable. But, the risk of mold development or serious corn deterioration is ever present.

In dry storage, more attention should be paid to grain distribution into storage, or cleaning prior to storage when grain quality is poor. Many elevator operators do not use distributors into big storages, and allow fines to accumulate in the center. The center of the bin is then withdrawn when filling is completed and either cleaned and returned to the bin or marketed. Several farmers have indicated that withdrawing the centers of bins during late November or December has markedly reduced their storage problems. It is assumed these are conditions in which the majority of fines are in the center core.

A correctly designed and operated aeration system in the storage is taken for granted. Aeration is generally necessary when more than 2000-3000 bushels are stored in one quantity. The wider the storage (the further the middle kernel is from the outside), the greater the need for aeration. Hanging type aeration units are typically used up to 4-5000 bu bin sizes. Floor systems are more satisfactory for larger bins.

Incorrect management of the aeration system is a common problem on farms. Most operators do not appreciate the amount of time required to bring about a change in the entire grain mass. So, they frequently start the fan, run it only in good weather for a day or two, and then shut it off, especially if weather conditions seem poor for dry grain. This generally leaves a layer of grain in the bin in transition and it may be in an unstable or undesirable condition.

At 1/10th cfm/bu, which is typical for most on-farm dry grain aeration systems, it normally takes 100 to 160 or more hours of continuous fan operation to bring about a temperature change throughout the entire grain mass. Any time the outside air
conditions are, on the average, 10°F or more below the average temperature of the grain in the bin, consideration should be given to running the fan.

Once the grain is cold (30-40°F), it is not generally necessary to run the fan, except for very short periods to check the exhaust for possible odors indicating spoilage. It is not necessary or even desirable to freeze grain by running the fan in extended periods of extremely cold weather. Weather this cold presents problems when grain is unloaded on warm balmy days (sweating), and can result in frozen chunks of grain in the bin if moist air is blown into the bin next spring.

INHALING DUST AT HARVEST

There have been numerous questions and rumors concerning the dangers of inhaling the heavy black dust evident when harvesting blighted corn. Up to this point, it has not been possible to document a case of serious illness for such dust. There have, however, been a number of cases where persons who have been exposed to the dust have experienced respiratory discomfort.

Samples of the dust have been analyzed and determined to contain many types of mold organisms including *H. maydis* spores along with considerable dirt and plant residues. So far as has been determined to date, there is no particular danger to people or animals, either from inhalation or consumption of the mold organism *H. maydis*, but caution is advised. Some people may have or develop allergic reactions to one or several of the mold organisms present. But so far as can be determined to date, there is no danger to people from the mold *H. maydis* itself giving rise to toxic conditions or infecting animal or human tissue.

Machine operators should be cautioned, however, that any time they work in excessive dust concentrations for any period of time, they should take some precautions. Excessive dust inhalation can apparently give some people what might be called a "dust cold," with symptoms not unlike early or light flu cases. The use of a breathing mask with a replaceable or washable filter is advised under such conditions. Any filter that will collect fine dust is probably satisfactory.

The use of closed filtered air circulation systems on the harvest machine cab may also be desirable. Such recirculation would be common with air conditioning, and may only be tolerable in warm weather with the use of cooling. Bear in mind that the earlier harvest period with blighted corn will mean operation in warm or even hot weather. Air conditioning may be necessary if dust is to be excluded from the cab.

SAFETY WITH MACHINERY

Field conditions this fall will present many machine clogging and shelling problems in down and rotten corn. Harvest may involve longer, more tedious hours that will mean frustration and extra fatigue.

Machine operators should be repeatedly cautioned to think of safe man/machine practices, and to recognize the added dangers when fatigued, frustrated, and hurrying to make up for previous losses.

REFERENCES

The following publications contain more detailed information. Copies or source information is available from your county cooperative Extension office.
1. Pamphlet, "The Invasion of the Southern Corn Leaf Blight into Indiana during recent weeks has caused great concern." Here follows background information that may help you assess the situation. Herbert H. Kramer

2. USDA FB 2238, "Guidelines For Mold Control in High-Moisture Corn"

3. No. 919, "Drying Ear Corn by Mechanical Ventilation"

4. AE-71, "Aeration For Safe Grain Storage"

5. AE-67, "Selecting A Grain Drying Method"

6. MWPS-13, "Planning Grain-Feed Handling"

7. "High Moisture Corn in Horizontal Silos," Prairie Farmer Article, June 1970, G. W. Isaacs, Head, Agricultural Engineering, Purdue University

8. AE-72, "Dryeration"

9. Circular 624, "Watch Out For Silage Gas"

10. S-42, "Safety Makes Sense with Silo Gases"

11. S-51, "Safety in Corn Harvesting"

12. USDA FB 2071, "You Can Store Grain Safely on the Farm"