Lesson 7: Harvesting and Storing Grains

Use of proper grain harvesting procedures is necessary to ensure that farmers are able to harvest all of the grain they produce. Harvesting time and methods, storage requirements, and grain drying procedures will be topics of discussion in this lesson.

Harvest Time

Determining the optimum harvest time is critical for profitable grain production. The best time to harvest is when the producer receives the highest yield of the highest quality. Choosing the correct time to harvest can be the difference between profit or loss. Factors that determine the proper time to harvest grain crops can be divided into three categories: plant characteristics, climatic factors, and harvesting methods.

Plant characteristics refer to the plant's stage of maturity, tendency to lodge (bending or breaking plant stems), and tendency to shatter (the loss of grain, or seed, from the inflorescence, or head). Delaying harvest beyond the optimum time decreases yield and increases the possibility of loss due to lodging and shattering.

Climate is also a consideration in harvesting because of the effect it has on mature crops. Rainfall, humidity, wind, and temperature affect crop moisture content. Harvesting crops with a high moisture content may increase storage losses due to molding and overheating. Adverse weather conditions can also damage crops that are ready for harvesting. Also, grain harvesting equipment may not be usable in muddy fields.

The harvesting method used will also influence the optimum harvest time. Windrowing small grain crops may allow for earlier harvesting since the crop moisture is reduced somewhat in the windrow before threshing. Grains dry more quickly in a windrow than as standing crops. Combining standing grain will generally result in harvesting at a higher moisture content than with the windrow harvesting method. However, windrow harvesting may increase losses due to shattering. Optimum harvest times vary with the crop and its anticipated use. Table 7.1 identifies the characteristics that indicate the proper harvest time for common grain crops.

Table 7.1 – Characteristics of Proper Harvest Time

Crop	Percent Moisture	Plant Maturity Stage	Physical Plant Signs for Harvest	Method Used to Harvest
Wheat	below 14%	a little past hard-dough stage	majority of kernels shell out when rubbed betwen hands	direct combine
Oats	no more than 13-14%	hard-dough or 2-3 days later	when the straw shows no greenness and the heads have turned a dull white	direct combine or windrow-pickup combine
Barley	below 14%	hard-dough stage	when heads have turned golden yellow but straw may be slightly green	direct combine or windrow-pickup combine
Corn (grain)	15.5%	50-60 days after pollination	kernels are nearly all well glazed and dent corns, well-dented husks and bottom leaves dry, upper leaves 1/4 to 1/2 green	direct combine
Corn Sillage	65-70% (for plant)		kernels well glazed, and husks begin to turn yellow although most leaves are green	field chopped

Grading Grains

In 1916, the U.S. Grain Grading Act was passed, requiring that all grain shipped to or from the U.S. be inspected and graded. Specific procedures for sampling grains were established. Grain samples were used to assign a class and grade for marketing purposes.

Factors used in federal grain grading are: class, test weight per bushel, percentage of damaged grain, percentage of foreign materials, and percentage of other classes. Class refers to the varieties that exist in each type of grain crop. For example, wheat consists of seven classes. These classes are hard red spring wheat, durum wheat, red durum wheat, hard red winter wheat, soft red winter wheat, white wheat, and mixed wheat. Some classes may have subclasses. Grain crops may have from one to several classes. For example, flaxseed has only one class whereas wheat has seven classes.

Determining the classification is part of the grain grading process. The weight of a grain sample is used in estimating the moisture content and percentage of dry matter. Percentage of damaged seed (grain) is estimated as a percentage of the sample and then extrapolated to the whole shipment. Percentage of foreign material refers to weed seeds, weed plant parts, insect parts, or any material other than the seed. The percentage of other classes includes any other class of grain that is found in the shipment. All of these factors are considered when determining the grade of a grain sample. The market price for grain is based upon the grade classification of a representative sample of grain.

Grain Quality Factors

Factors that determine grain quality are purity of crop and variety, percentage of weeds and other mixtures, and percentage of diseased and damaged kernels. Each of these factors influences the quality of a grain sample.

Methods of Harvesting

Methods of harvesting vary with the type of crop. Methods most commonly used are direct combine method and windrow-pickup combine method. The direct combine method utilizes combines with interchangeable gathering units (heads) depending on the crop. The direct combine method involves cutting and threshing (the separation of grain from the rest of the plant material) the standing grain in the same operation. With direct combining, the threshed grain can be held in a hopper on the combine.

The windrow-pickup combine method places the cut, but unthreshed crop in rows for field drying. After the grain has dried in the windrows, it is gathered by a combine equipped with a pickup attachment. After the threshed grain is accumulated in a hopper, it is then loaded into grain trucks for transportation.

Improperly Stored Grain

Much of the profit potential from grain production can be lost due to improper storage. Economic loss during storage may be caused by high moisture content, heat damage, rotting, improper drying, foreign material, and insect and rodent infestation. Mold can be a problem if grains are harvested and stored when the moisture content is too high. If moisture content is too high, the grain will heat up, encouraging rotting and spoilage. Foreign material in the grain such as weed seeds, plant parts, and insect parts can encourage grain spoilage. If adequate storage is not provided, insects and rodents can infest the grain and reduce the quality by contamination.

Maintaining Crop Quality

Maintaining crop quality can be accomplished using good management practices. The primary goal of a grain storage facility is to retain the quality of stored grain. Several steps can be taken to maintain crop quality: harvesting grain at the proper moisture content, properly constructing and maintaining storage bins, protecting against pests, providing proper ventilation, protecting from fire and wind damage, and inspecting the grain frequently.

Harvesting grain at the proper moisture content is vital for good storage. The maximum moisture content for various grains follows: shelled corn grain, 13 percent; hard red spring wheat, 13 percent; soft red winter wheat, 12.5 percent; hard red winter wheat, 12 percent; and soybeans, 13 percent.

Properly constructed and maintained storage facilities reduce grain spoilage. Cleaning and disinfecting facilities between

storage seasons discourages entry by pests. Providing proper ventilation also decreases the possibility of grain deterioration. Frequent inspections are also recommended to prevent losses due to unexpected problems.

The facility should provide protection against fire and wind damage. Other factors to consider would be the convenience to fill, empty, and inspect. The facility should be structurally sound and able to withstand lateral pressure when full. For example, there are approximately 300 pounds of lateral pressure per square foot on the bottom wall of a 2,000-bushel round bin that is 16 feet in diameter by 12 feet deep. All of these factors should be considered when deciding on a storage facility.

Drying Grain

The ability to dry harvested grain in storage provides many advantages to grain producers. Early harvesting may be necessary to avoid weather conditions that would contribute to excessive harvest losses. Market prices, which may be higher early during the harvest time, decrease as the harvest season progresses. Artificial drying can help reduce losses from molds, heat damage, and spoilage due to high moisture content. Drying grains in storage to the proper moisture content helps to maintain crop quality. The methods of drying grain crops are drying with unheated air, drying with heated air, and drying in the field.

Unheated air may be used to dry harvested grain that contains no more than 15 percent moisture. Unheated air must have a relative humidity of 70-75 percent or less to decrease the grain moisture content. During the final drying stages, unheated air must contain less than 50-60 percent humidity to reduce the grain moisture content to 13 percent. Bins for drying must be equipped with perforated ducts or false floors to allow the air to be forced through all parts of the bin by a ventilating fan.

Advantages of drying with unheated air include lower expense for energy, less fire hazards, lower initial equipment costs, little management and supervision, and less chance of overdrying. Disadvantages arise because the unheated air uses outside air which is affected by natural weather conditions. Unheated air systems are not effective in cold, damp conditions. Other disadvantages are slower drying rates, more drying time required, and greater possibility of damage from mold due to prolonged drying times.

Drying with heated air is accomplished by heating the air with natural gas or petroleum fuels and forcing the heated air throughout the storage bin. The heat from each gallon of fuel will evaporate 50 to 85 pounds of water from the grain if direct heat drying is used. If indirect heating is used, 35 to 60 pounds of water can be removed.

The advantages of using heated air are increased ability to dry the wettest grain, no dependency on weather conditions, shorter and faster drying times, and high drying capacity. The disadvantages of using heated air drying are higher initial cost, higher fuel expense, some fire hazard, potential to overdry grain (thus reducing quality), and requires more careful management and supervision.

In field drying, the crop is allowed to dry to the appropriate moisture content while standing or after cutting, conditioning, and windrowing. The standing crop is harvested with the appropriate combine head attachment. Windrowed crops can be picked up once they reach the correct moisture content using a combine windrow-pickup attachment.

Summary

Successful on-farm grain processing involves proper harvesting and storage. Producing and marketing grain of high quality is a result of good management decisions. Decisions that consider proper harvesting times, harvesting methods, and storage methods that maintain grain quality, are important in the overall grain production process.

Credits

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