

AEN-25

HARVESTING, DRYING & STORING SOYBEANS

ISSUED: 9-73

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The harvesting, drying and storage of soybeans has received only limited attention from researchers throughout the country. However, results of this limited research and field observations have indicated that certain precautions must be taken during harvest if a farmer is to realize maximum returns from his crop. It has been estimated that an average operator will leave from 2 1/2 to 4 bushels of soybeans per acre in the field. Considering the price of soybeans, this is a sizeable loss to the farmer. Certain precautions can be taken to reduce field losses and maintain the quality of soybeans.

Harvesting

When to Harvest:

The moisture of the bean and the hull determine the best time for harvesting soybeans. The range for harvesting soybeans has been indicated as being from 9% to 20% moisture content (wet basis). The soybean is considered to be fully mature well before the bean can be harvested with present field equipment. Research at the University of Missouri indicated that soybeans can be harvested at 15% moisture content and that there is less seed damage at higher moisture contents. Because seed damage increases as the moisture content decreases, it is necessary to harvest the seed promptly if the moisture drops below 13.5%. The research indicated that there is considerably less visible damage to the soybean when it is harvested above 13.5% moisture and it should be harvested prior to reaching 11.5% in order to reduce excessive creakage. It was also noticed that soybeans which had been field dried to a moisture content below 13.5% and then subjected to rain tended to have a higher percentage of cracked seed coats when harvested.

Operating the Combine:

The most important items to consider when operating the combine are ground speed, reel speed, cutterbar height and separation of soybeans from pods. The combine should be operated at an average speed of from 2 1/2 to 4 miles per hour. Fast ground speed can result in high losses from the header. The ground speed can be estimated by dividing the number of three foot steps covered by the combine in 20 seconds by a factor of ten. This will give an estimated miles per hour ground speed.

The ground speed should also be matched to the combine reel speed. The best speed ratio is a reel speed 1.25 times the combine ground speed. A low reel speed reduces shattering.

Soybeans should be cut as close to the ground as possible. For best results, a cutting height of about 2 1/2 inches above the ground is recommended. This will normally require special equipment such as a floating cutterbar or an automatic header control. Field losses are increased about 10 percent when the beans are cut 3.5 to 4 inches above the ground.

Cylinder speed is quite important in reducing the amount of seed crackage. High cylinder speeds of 700 and 900 rpm result in higher seed crackage than a speed of 500 rpm. It may be necessary to use a cylinder speed slower than 500 rpm if excessive seed crackage occurs. The operator's manual should be followed in determining the initial settings for the cylinder speed and concave spacing.

It may be necessary to change the cylinder speed as the harvest progresses and the moisture content changes. Soybeans at high moisture contents require more energy to remove the bean from the pod. Therefore, the cylinder speed has to be higher and the concaves set closer for high moisture conditions. As the beans dry out, the cylinder speed can be slowed and the concaves adjusted open. The combine's blower fan may have to be slowed down to prevent beans from being carried over the back of the combine as the moisture content drops.

The reel axle should be 6 to 12 inches ahead of the cutterbar and the reel-bats should leave the plants just as they are cut. The reel depth should be just enough to control the beans. A six-bat-reel will normally give more uniform feeding.

Measuring harvest losses is quite important in determining combine adjustments. An average of four beans per square foot is equivalent to about one bushel per acre loss. To properly adjust the combine, it is necessary to make three measurements. They are (1) preharvest loss, (2) gathering unit loss, and (3) total crop loss. To measure these losses, a rectangular frame can be constructed which will enclose an area of ten square feet and be equal in width to the combine header. To measure the pre-harvest loss, the frame should be placed in the standing beans in front of the combine and the number of beans on the ground counted. The gathering unit losses are determined by placing the rectangular frame in a space that only the header has covered and counting the beans on the ground. This can be accomplished by stopping the combine and backing up several feet. The total crop loss is measured in an area well behind the combine where all the beans in the frame are counted. In each case the number of beans is divided by 40 to determine the number of bushels per acre loss. These procedures are explained more fully in a publication available from the Agricultural Engineering Department at the University of Kentucky, "A Guide for Measuring Soybean Harvest Losses."

Drying

Soybeans can be dried with conventional drying equipment. However, the percentage of cracked beans increases rapidly with the drying temperature. Research at the University of Kentucky indicates that little cracking occurs if the temperature of the drying air is 70°F or below, but there are significant differences among the varieties with regard to cracking when higher drying temperatures are used. For 100°F, the percentage of the beans which had skin cracks ranged from 10~60%. For 130°F, the range was 50-90%; and for 160°F, 80-100%. For 100°F drying temperatures, the beans which cracked below the skin ranged from 5 to 20%. For 130°F, this range was 20 to 70%; and for 160°F, 30 to 80% of the beans cracked. There was considerable variation for the same variety, but of those varieties tested, Dare was the most resistant to all forms of cracking, followed by Clark, Calland, Kent, and Cutler. How many of the cracked beans will become splits, and the effects of drying temperature on germination and storage of soybeans are questions which have yet to be answered. Research now being conducted at

the University of Kentucky will address these problems. At the present time, a drying temperature below 110°F is recommended.

The resistance to air flow by soybeans is approximately 25 percent less than that produced by shelled corn. The use of drying facilities designed for corn will allow about 25 percent deeper depths when drying soy beans if the temperature of the drying air remains the same. However, it may be more desirable to use a shallower depth of soybeans to allow more air flow and compensate somewhat for the lower temperatures recommended for soybean drying.

Storage

Moisture Content:

Soybeans should be stored at 11% moisture content (wet basis) or less, depending on the temperature of the grain during storage and the length of time the crop will be stored. If soybeans are to be stored over the summer months, the moisture content should be about 9% to eliminate the possibility of spoilage in storage.

Clean Grain:

Excessive trash should be removed from soy beans before they are stored. Accumulation of trash in small pockets in the grain bin can cause heating and decay which may lead to insect problems. Normally, the cleaning of soybeans requires the removal of particles larger than the grain kernels.

Aeration:

Soybeans should be cooled after placing them into a storage bin. Cooling can be accomplished with an adequately designed aeration system. The aeration system should be designed to move air down through the grain at a rate of about 1/10 cfm per bushel. The grain should be cooled anytime the grain mass is 10°F above the outside air temperature until the grain mass has been cooled to 40°F to 45°F. Drying fans (with heater turned off) can be used to aerate grain by forcing air up through the grain for three to four hours. A properly designed and installed aeration system can eliminate the need for "turning" the grain or moving the grain in the event it gets hot due to respiration.

Safety

Precautions should be taken when entering a grain bin. Never enter a grain bin while the unloading auger is operating. The moving grain can pull a person below the grain surface in less than five seconds in some systems. Always have a ladder installed on the outside and on the inside of every grain bin. Disconnect the electrical power for motors on unloading augers or remove the belt drive when entering a bin of grain unless even/one on the ground knows you are in the bin. Always check inside the grain bin before turning on the unloading auger in case someone has entered the bin without your knowledge. Flowing grain is dangerous.