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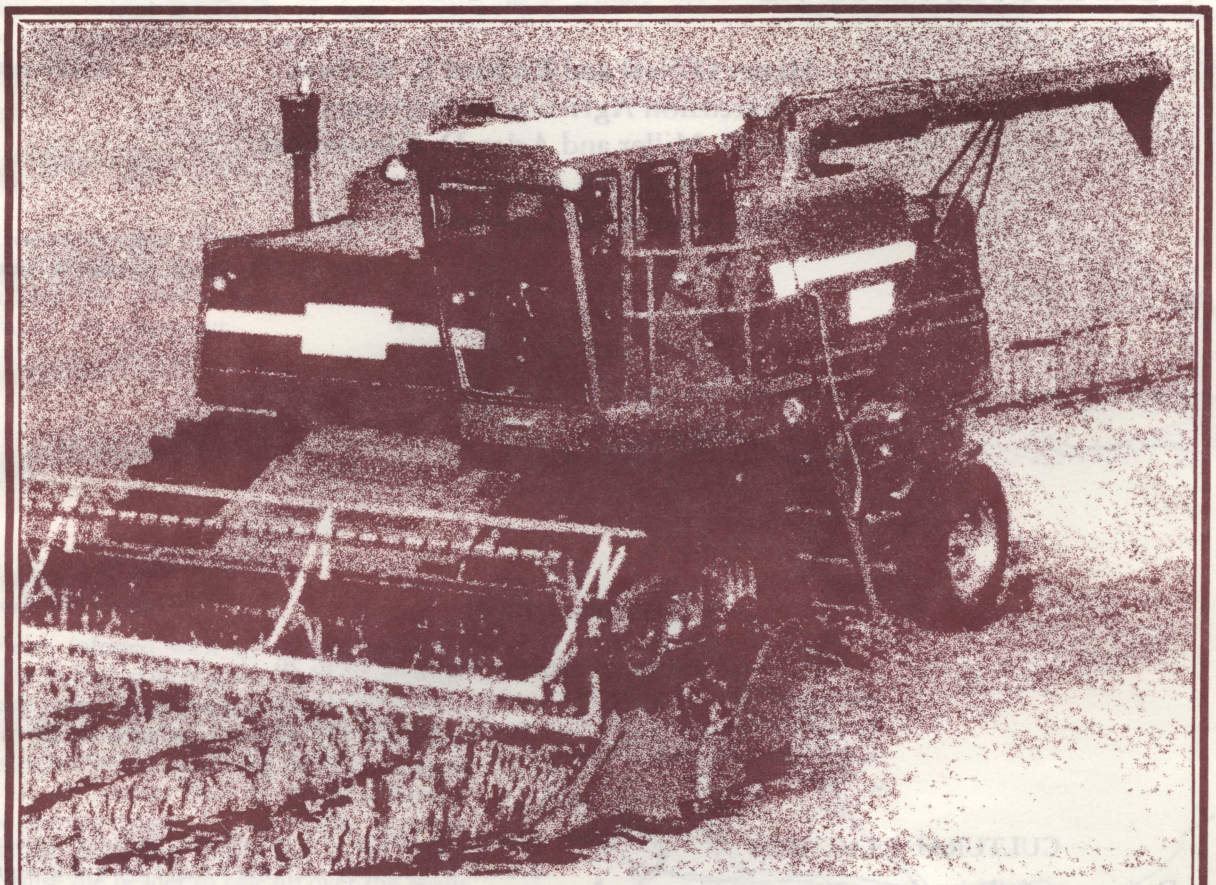

Harvesting & Storing Soybeans

Texas Agricultural Extension Service • Zerle L. Carpenter, Director • The Texas A&M University System • College Station, Texas

HARVESTING AND STORING SOYBEANS

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INTRODUCTION

Soybean harvest losses may frequently be 10 to 20 percent of the standing crop production. Since every bushel of beans saved is clear profit, consider factors contributing to harvest losses.

CULTURAL PRACTICES

Decisions made during the growing season can reduce soybean harvest losses. Planting rate and row spacing have a substantial effect on the shape of soybean plants. At low populations and wide row spacing, soybean plants usually are bushy and set pods on long lateral branches near the ground. As populations increase, pods are set closer to the plant's main stem and higher up from the soil line.

One major source of combine header loss is low growing soybean lateral branches which are cut off but not picked up by the combine. The change in plant shape at high populations reduces this loss. However, be cautious about excessively high populations, as stalk diameter decreases with increasing plant competition and lodging becomes a problem. Studies at Beaumont show little yield difference between plant populations of 65,000 and 130,000 per acre. Above 130,000 plants per acre, weak spindly stems and sterile non-bearing plants contribute to yield and harvest loss through competition and lodging.

Reduced row interval affects plant morphology similar to that of reduced plant population. At a normal plant population, pod height may be lower and lateral branch length may increase when row width is greatly reduced. Producers may reduce harvest loss on narrow row or broadcast soybeans by increasing the plant population 25 to 50 percent over that used on conventional row spacings.

Bed planting is a cultural practice that reduces harvest losses. Planting on top of a high, shaped bed allows the combine header to cut lower on the plant, reducing potential harvest losses.

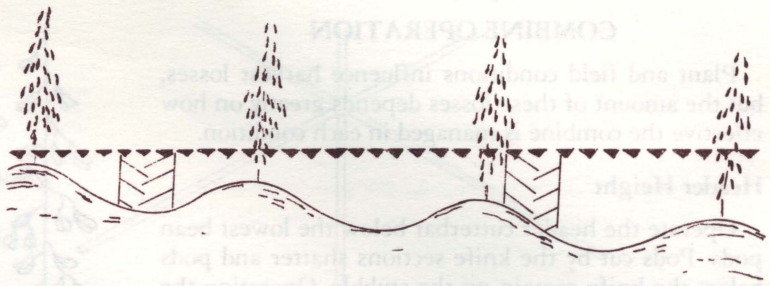
WEED CONTROL

Weed control influences harvest losses in several ways. Producers who cultivate more than once, or throw a considerable amount of soil against the plant, often suffer considerable harvest loss as lower pods may be covered with soil or be too low to retrieve with the combine. During cultivation, set sweeps or rolling cultivator tines so that a minimum of soil is thrown against the soybeans. Cultivation and weed control losses are minimized by an effective chemical weed control program.

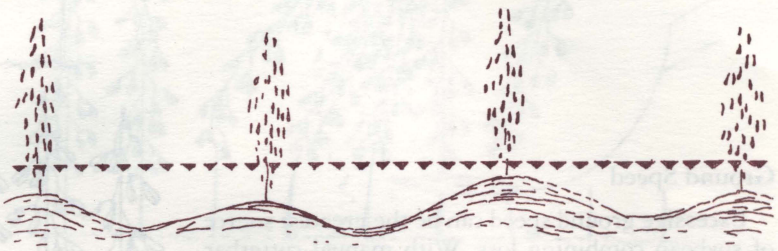
FIELD CONDITIONS

Row Spacing and Height of Row

Select a row spacing that allows the combine header to handle complete rows. Match row spacing with combine drive wheel spacing. A mismatch can cause one wheel to operate on one row with the other wheel operating in the middle.

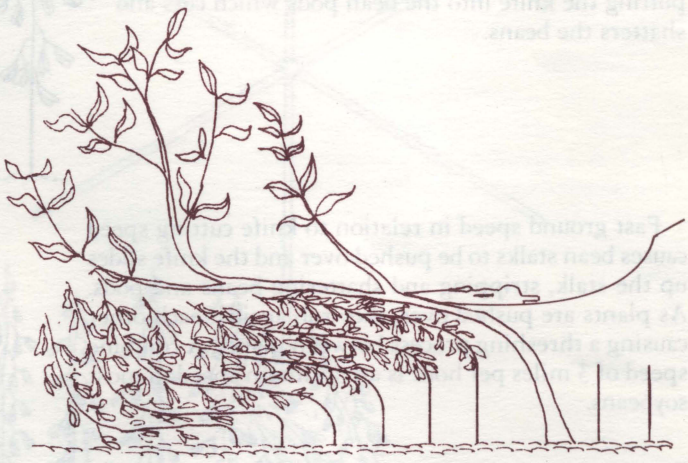


Uneven heights of rows can contribute to harvest losses. A high row can keep the combine header above beans on the other rows.



Weeds and Grass

Fields infested with weeds and grass are subject to higher bean losses than clean fields. Heavy weed infestations increase the volume of material passing through the combine, causing inefficient screening. Weeds and grass are usually greener than the beans at harvest time and can subject dry bean stalks to severe handling and cause shattering. Large weeds can cause the header to ride up over the beans resulting in losses on uncut stalks or the stalk to be cut high. Weeds with a sticky sap such as the black nightshade cause soybeans to stick together allowing them to ride over combine screens.



Moisture Content

If drying facilities are not available, harvest at a moisture content of 13 percent. When the moisture content is 10 percent or below, shatter losses become excessive. If drying facilities are available, harvest beans at moisture contents up to 20 percent.

HARVEST LOSSES

Preharvest Loss

Preharvest loss consists of loose beans and beans in pods that are detached from the stalk and lying on the ground before harvest.

Header Loss

Header losses are caused by actions of the cutterbar and reel and include shatter loss, pods left attached to the stubble, pods on cut stalks not delivered into the combine and pods on downed plants that are not cut.

Threshing Loss

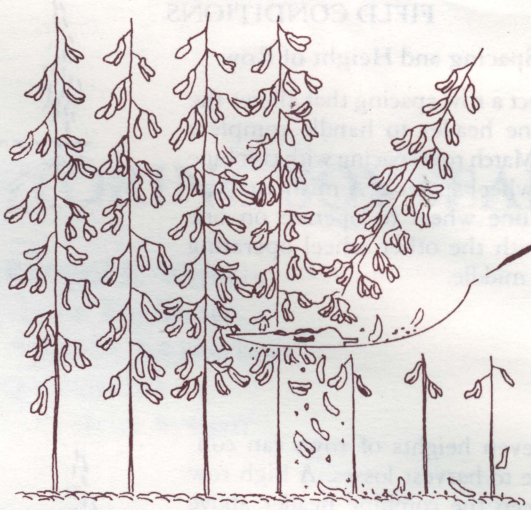
Threshing losses occur when beans and pods are not separated from the chaff and stalks while in the combine.

COMBINE OPERATION

Plant and field conditions influence harvest losses, but the amount of these losses depends greatly on how effective the combine is managed in each condition.

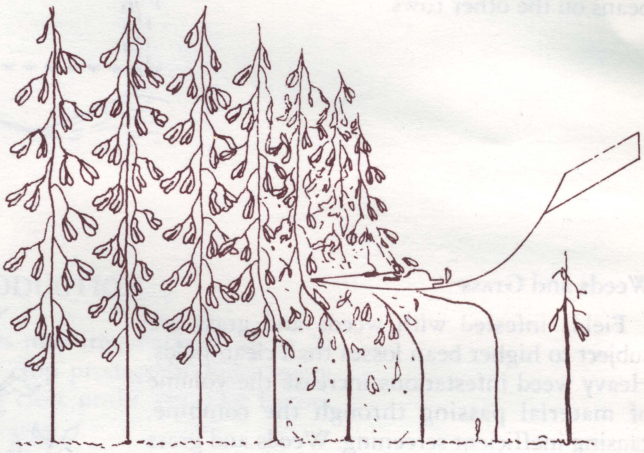
Header Height

Operate the header cutterbar below the lowest bean pods. Pods cut by the knife sections shatter and pods below the knife remain on the stubble. Operating the cutterbar at or near ground level requires automatic header controls—a spring loaded skid plate, finger sensing control or a floating cutterbar.



Ground Speed

Excessive ground speed can be the greatest source of soybean combining loss. With manual cutterbar control, it is difficult to keep the header low on the ground when operating at high ground speeds. The natural tendency of the operator is to lift the header, putting the knife into the bean pods which cuts and shatters the beans.



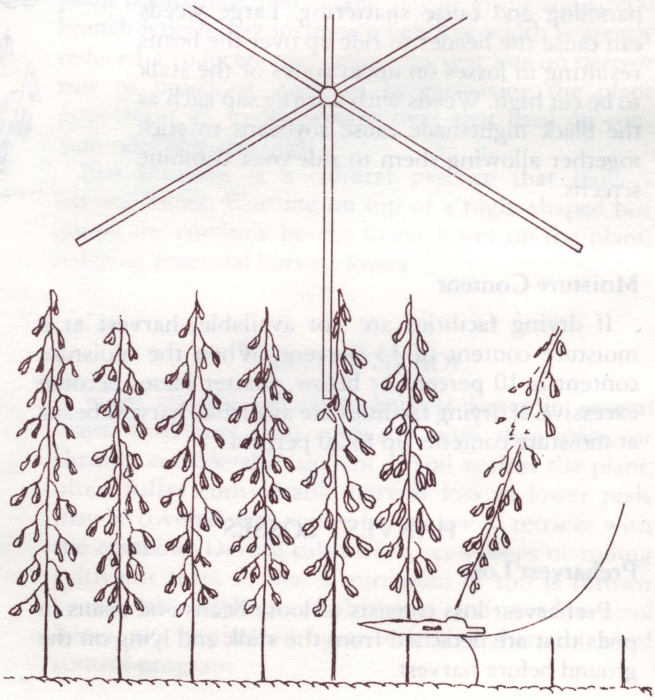
Fast ground speed in relation to knife cutting speed causes bean stalks to be pushed over and the knife slides up the stalk, stripping and shattering beans and pods. As plants are pushed over, they rub against each other causing a threshing process between plants. A combine speed of 3 miles per hour is an optimum speed in most soybeans.

Reel Speed and Position

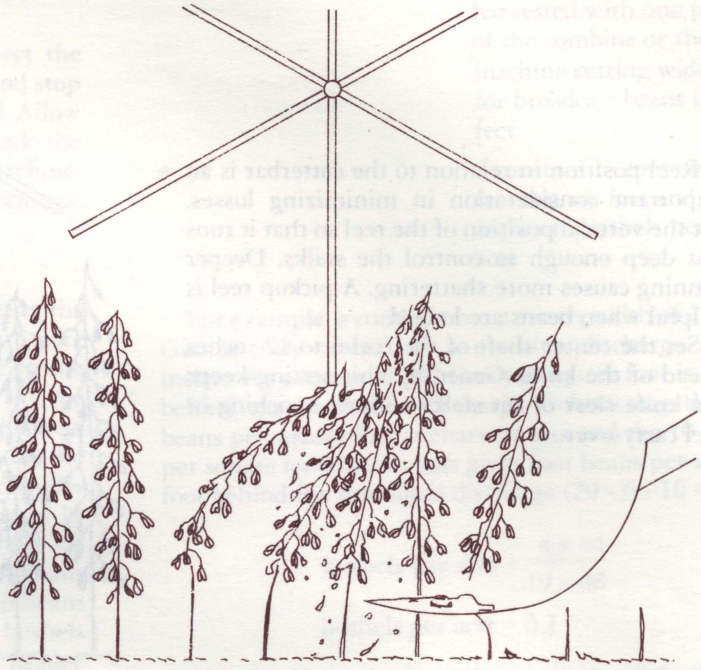
Reel agitation is a major contributor to loss from shattering. Reel speed in relation to combine ground speed and the reel's vertical and horizontal position in relation to the cutterbar are important considerations.

The reel holds bean stalks in position while they are being cut and then moves the stalks from the cutterbar. The reel should do its job with little plant disturbance to minimize shattering.

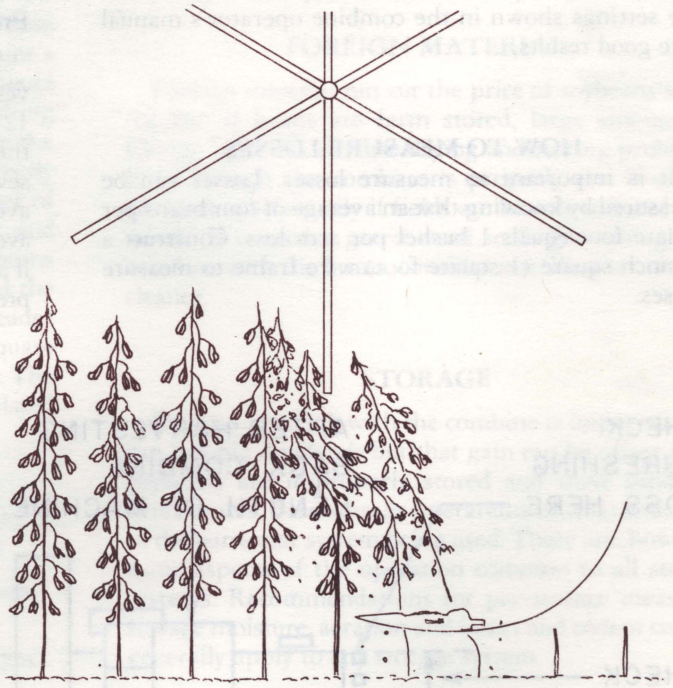
Maintain reel speed about 25 percent greater than combine ground speed. For a 42-inch diameter reel, reel speed should be about 10 revolutions per minute for each mile per hour of combine ground speed.

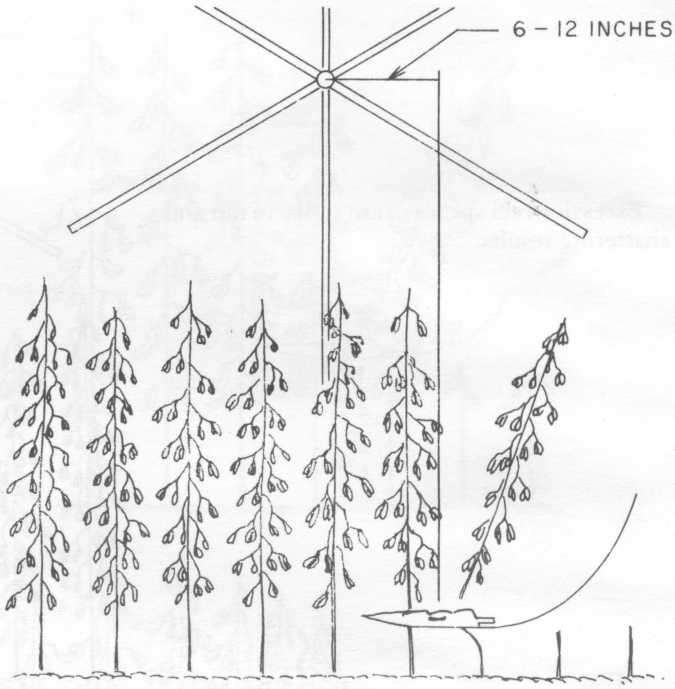


Excessive reel speeds cause stalks to fan and shattering results.



If the reel runs slower than the combine ground speed, it drags the stalks causing shattering.





Reel position in relation to the cutterbar is an important consideration in minimizing losses. Set the vertical position of the reel so that it runs just deep enough to control the stalks. Deeper running causes more shattering. A pickup reel is helpful when beans are lodged.

Set the center shaft of the reel 6 to 12 inches ahead of the knife. Generally, this setting keeps the knife clear of cut stalks without bunching or reel carry-over.

Threshing

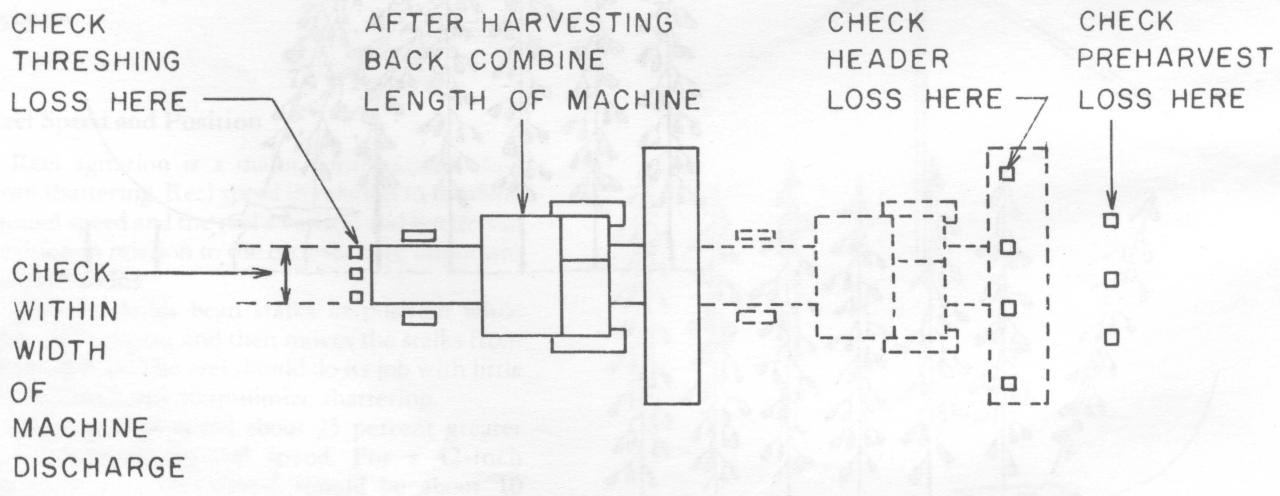
Cylinder and separation losses are usually low, since soybeans are easy to rub out of the pod. In most cases, the settings shown in the combine operator's manual give good results.

HOW TO MEASURE LOSSES

It is important to measure losses. Losses can be measured by knowing that an average of four beans per square foot equals 1 bushel per acre loss. Construct a 12-inch square (1 square foot) wire frame to measure losses.

Preharvest Loss

To determine preharvest loss, select a typical unharvested area of the field well in from the edges. Place the 12-inch square wire frame in the standing crop. Count the beans lying on the ground in the frame. Make several random samples and average them to find the average and divide the average by 4. This gives the average preharvest loss in bushels per acre. For example, if an average of six beans is found within the frame, the preharvest loss is 1½ bushels per acre (6 divided by 4 = 1½).



CHECKING SOYBEAN HARVEST LOSS

Machine Loss

When checking machine loss, first disconnect the straw spreading device. Harvest a typical area and stop the combine well away from the edge of the field. Allow the combine to clear itself of material and back the combine a distance equal to the length of the machine. This permits checking header and threshing loss without stopping the combine several times.

Header loss. To check header loss, after backing the length of the combine, place the 12-inch square wire frame on the ground in front of the combine in the harvested area. Count the number of beans in the frame. Check several other areas and average the bean count. Next, substract the number of beans found in the preharvest check and divide by 4. This gives the header loss in bushels per acre. For example, an average of 16 beans is found within the frame. Subtracting the six beans per square foot preharvest loss gives 10 beans per square foot of header loss. Dividing the 10 beans per square foot by 4 gives a header loss of 2½ bushels per acre (10 divided by 4 = 2½). The range of header losses is 10 to 12 percent of the average yield.

Threshing loss. Threshing losses are usually very low with a typical loss ranging from ½ to 1 percent. These losses may be observed by watching the machine's discharge while the combine is operating. Beans should not be blowing out with the chaff. To check threshing loss, after backing the length of the combine, place the 12-inch square wire frame on the ground directly behind the machine's discharge. Count the number of beans in the frame. Check several other areas and average the bean count. Subtract the number of beans per square foot found in the preharvest check and the number of beans per square foot found in the header loss check from the average number of beans per square foot found directly behind the machine's discharge. The threshing loss in bushels per acre may then be calculated with this formula.

$$\text{bushels per acre} = \frac{\text{beans per square foot} \times \text{discharge width (inches)}}{\text{swath width (feet)} \times 48}$$

- bushels per acre — threshing loss in bushels per acre
- beans per square foot — average number of beans per square foot found directly behind the machine's discharge less the number of beans per square foot for pre-harvest and header loss
- discharge width (inches) — machine's discharge width in inches
- swath width (feet) — width of number of rows harvested with one pass of the combine or the machine cutting width for broadcast beans in feet
- 48 — a constant to convert feet, square feet and inches to bushels per acre

For example, a combine has a swath width of 19 feet (six 38-inch rows) and a machine discharge of 44 inches. An average of 20 beans per square foot is found behind the machine's discharge. Subtracting the six beans per square foot preharvest loss and the 10 beans per square food header loss gives four beans per square foot behind the machine's discharge (20 - 6 - 10 = 4).

$$\text{bushels per acre} = \frac{4 \times 44}{19 \times 48}$$

$$\text{bushels per acre} = 0.2$$

Substituting in the formula gives a threshing loss of 0.2 bushels per acre.

FOREIGN MATERIAL

Foreign material can cut the price of soybeans at the market. If beans are farm stored, large amounts of foreign material increase drying and storing problems. Even though the combine is properly set, it cannot perform satisfactorily if fields are heavily infested with weeds. If excessive green weed seeds get through the combine with the beans, consider installing an auxilary cleaner.

STORAGE

Doing a good job with the combine is important and can pay big dividends but that gain can be offset if the soybeans are improperly stored and their condition deteriorates. Base storage operations on characteristics of the particular system being used. There are, however, some aspects of the operation common to all storage systems. Recommendations for pre-storage measures, storage moisture, aeration and insect and rodent control generally apply to any storage system.

Pre-Storage Measures

Before putting soybeans into a bin, clean it out. Never put new soybeans on top of old soybeans. Use brooms, hoes, shovels and vacuum cleaners to remove all of the old and cracked kernels. Clean walls, ceiling, ledges, sills and floors. Clean behind partitions, between walls, under false floors and in cracks and crevices.

Check outside and under the bins and clean up any spilled grain. Remove and burn all sweepings and debris. Plug all holes against birds and rodents. Make sure the roof is in good repair so rain cannot leak in.

Do not store soybeans near feed rooms, stables or animal feeders. These areas may harbor insects which can infest stored grain. Wagons, trucks and combines in which waste grain accumulates also serve as sources of insects and should be cleaned before hauling soybeans to storage facilities.

As another pre-binning precaution, do not put the first few bushels of soybeans going through the combine into storage. This insures that leftover grain is removed from the machine.

Eliminate weeds and grass under and around storage facilities since grain spills in these areas are concealed and provide an environment for insect development.

Storage Moisture

A major hazard to safe storage of soybeans is the development of molds. Moisture is a major factor influencing mold development.

The most effective methods for controlling molds is to reduce the moisture content of soybeans to a level at which molds do not grow. The long term safe storage moisture content for soybeans is 11 to 12 percent depending on climatic conditions where beans are stored. Warm, humid areas should adhere to the low moisture recommendation. It is important to understand that insects and molds do not recognize averages. Any place in the stored beans with moisture in excess of the recommendations is a candidate for problems.

Use any approved drying method to reduce moisture to a safe storage level. If storage bins are equipped with fans properly sized for aeration, discontinue drying when the moisture content is within a point or two of the recommendation. Proper use of aeration equipment normally removes the final points within a tolerable period.

Aeration

Aeration is the term used for forcing atmospheric air through the stored beans. This is a means of regulating temperature in the bin.

When beans are placed in storage the first objective is to reduce the temperature as much as possible, as quickly as possible. Next, eliminate unequal temperatures within the stored beans occurring from pockets of insect infestation or vegetative material and/or seasonal atmospheric air temperature changes.

Generally, operate the aeration fan when the atmospheric air temperature is 10° to 15° F. below the stored bean temperature. This applies to cooling as well as temperature equalizing. Another rule is to push the air in the summer to avoid pulling hot, head space air through the beans and to pull the air in the winter to avoid condensation from warm air contacting cold metal at the top of the bin.

Effective aeration can be obtained with airflow rates as low as 1/10 cubic feet per minute of forced air per bushel of stored soybeans. Fan and air distribution systems used for drying beans are also satisfactory for aeration.

Continue aeration during periods of satisfactory atmospheric air conditions until the stored bean temperature is comparable to the atmospheric air temperature. Then operate fans 2 to 3 hours each week. As atmospheric temperatures decrease in the fall and winter, continue aeration during periods of satisfactory atmospheric air conditions until the stored bean temperature is 50° F. or as low as possible. Do not run fans during rainy or foggy periods.

Insect and Rodent Control

Pre-storage clean-up and continuing housekeeping have a positive effect on insect and rodent control. Stored bean moisture and temperature reduction also benefit insect control.

ACKNOWLEDGMENT

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