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Conditioning Hybrid Seed Corn

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CONDITIONING HYBRID SEED CORN

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First, let us always keep in mind that we are working with a living product and our goal is to condition the seed, keep it pure, viable and vigorous, and to improve it as we can.

Most of the hybrid seed corn is harvested and delivered to the seed plant facility on the ear. Depending on the year and harvest conditions, the ears are harvested at 35% moisture or below and received at the plant with all of the refuse that is not removed by the picker.

Always look at the equipment to be used in conditioning with the following design criteria in mind:

a. Damage - will the equipment cause damage to the seed?

b. Contamination - are there any areas in the equipment that could hold or trap seed to contaminate other varieties?

c. Application - does the equipment fit the application with regard to capacity, use, space and the job to be performed?

d. Maintenance - is the equipment going to require a lot of maintenance or very little?

With these criteria in mind, let us then follow the corn seed on its journey through the different operations at the seed plant.

Receiving

The seed is received in bulk, on the ear, and dumped onto a receiving conveyor and is elevated by incline conveyor to the husking facility. The best conveyor for receiving is a vibratory conveyor, as it meets all the design criteria, and does not slip or stop under load or wet conditions. A belt conveyor can also be used, particularly if the horizontal section and the inclined conveyor to husking is all one unit.

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The belt conveyors should be designed to use at least a minimum number of rollers under the belts to cut down on the amount of friction which in turn requires less horsepower to pull the load. These are called "Trough-Roller conveyors" versus the "Slide-Bed conveyors." (See Figure 1.)

When a belt conveyor is used in a incline configuration the following guidelines should be followed:

0 to 10^{o} of inclination - Standard belt

10 to 15^{o} of inclination - Rough top belt

15 to 30^{o} of inclination - Cleated belt

It is not recommended to have a conveyor at a greater incline than 30^{o} as the capacity is cut appreciably due to roll back.

Incline conveyors, as well as horizontal conveyors, should always be belts rather than chain to fit our design criteria.

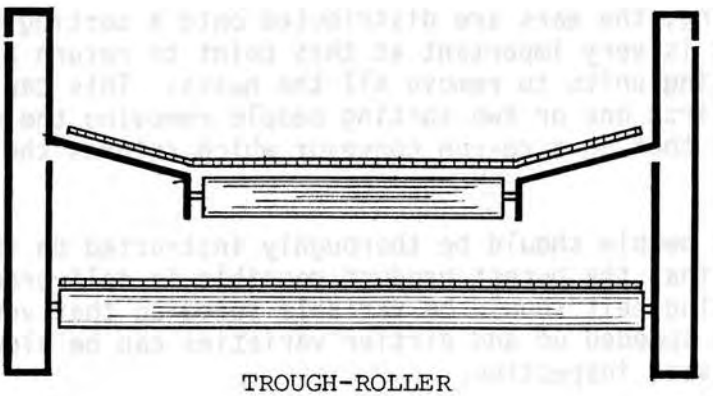
We should also note, at this point, that one of the best belts to use is PVC (Polyvinyl-chloride). This material is acid, oil, mildew and moisture resistant, has minimal stretch, and summer-winter temperature extremes do not affect it as much as other materials. Also, at present, it is less expensive than rubber belts.

Cleated belts should have a minimum of 1 1/2" high cleats (maximum of 3" high) and should be on 12 to 18" centers. A return caged or star idler should be used instead of a slide pan to cut down on friction, wear and horsepower.

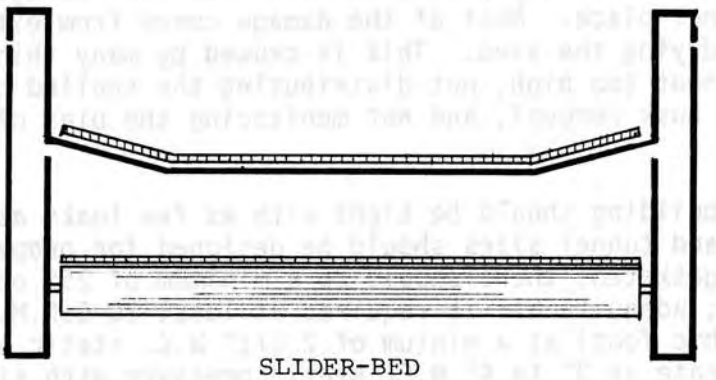
Husking and Sorting

After the incline conveyor delivers the seed into the husking building it should be thoroughly and completely husked. Ears that are not husked cause additional drying costs, do not dry uniformly, and do not handle or shell as easily.

There are many methods of distributing the ears to the husking machines. These methods should be researched and developed for your own particular plant requirements. But, is it important to select a system that distributes the ears uniformly and evenly onto the husking beds for the most effective and efficient husking job.



TROUGH-ROLLER



SLIDER-BED

Figure 1. Cross section views of two types of belt conveyors.

After husking, the ears are distributed onto a sorting belt to be hand sorted. It is very important at this point to return all unhusked ears to the husking units to remove all the husks. This can be accomplished by the first one or two sorting people removing the unhusked ears and putting them on a re-run conveyor which returns the ears to the husker.

The sorting people should be thoroughly instructed on the material to be sorted so that the purest product possible is delivered to the dryer. The sorting belt should be variable speed so that very clean varieties can be speeded up and dirtier varieties can be slowed down to enable better visual inspection.

A system should also be designed and provided to handle the refuse from the sorting area, which fits your needs and requirements. Most of the facilities now are set up to chop all the husks, cull ears and shelled corn for sale to a local feeder.

The sorted and husked ears are then conveyed to the dryer by a belt conveying system designed as mentioned before.

Drying

Drying is one of the most important and most abused operations in a seed plant. There are many plants we have seen that damage more seed here than any other place. Most of the damage comes from either over-drying or under-drying the seed. This is caused by many things--inadequate air, heat too high, not distributing the shelled corn evenly, inadequate or no husk removal, and not monitoring the bins closely enough.

The drying building should be tight with as few leaks as physically possible: door and tunnel sizes should be designed for proper air flow; doors should be gasketed; there should be a minimum of 25% open area in the drying floor; adequate air is required at least 20 C.F.M. per bushel (7 C.F.M. per cubic foot) at a minium of 2 1/2" W.C. static pressure (most dryers operate at 3" to 4" W.C. static pressure with single crosses).

In purchasing a new dryer facility, be careful to analyze it completely. A formula we use for capacity is as follows:

$$\frac{\text{Bin width} \times \text{Bin length} \times \text{Depth of ear corn}}{\text{Average through season of 2.8 cu. ft. per bushel}} = \text{Bu. per bin}$$

Example: 18 ft. x 20 ft. bin with an average corn depth of 10 ft. through the season.

$$\frac{18 \times 20 \times 10}{2.8} = 1282 \text{ bu. per bin approximately}$$

The number of bushels/bin times (x) the number of bins times (x) 20 C.F.M./bu. times (x) an 80% use factor will give you the air required at a minimum of 2 1/2 W.C. static pressure.

Example: 10 bin dryer of 18 ft. x 20 ft. bins.

10 bins x 80% service factor = 8 bins.

8 bins x 1282 bu. = 10,256 bu. to be worked on.

10,256 bu. x 20 C.F.M./bu/ = 205,120 C.F.M. at 2 1/2" S.P. minimum.

The burner-blower units should have a modulating temperature control that gives continuous heat as required. Do no use a thermostatatic ON-OFF control as it can cause stress damage to the seed by subjecting it to higher and lower temperatures. The burner-blower units should also have adequate safety controls to conform to your local codes and to insurance requirements. The minimum would be flame supervision, high temperature limit, air flow switch, and a fire alarm system.

There have been new developments on dryer temperature monitoring. Monitoring units now use thermocouples mounted in the top and bottom of each bin, at the blower discharge and an ambient point. These units come either in manual recording or print-out recording and the costs vary widely depending on your needs and requirements.

By recording the temperature of each bin, both top and bottom of bin, you can see what is happening in each and every drying bin. By generating a yearly history on each variety you can determine on the basis of temperature approximately when the bin is at a low enough moisture to shell. However, a sample should be taken to cross-check the readings. This will prevent, if properly handled and recorded, over-drying of seed which causes additional drying costs, additional sheller damage and weight loss. Temperature monitoring units are especially useful at night and on week-ends when your most experienced personnel are not at the plant.

By keeping records hourly you will find that invaluable data is generated which will help you to improve quality, lower drying costs, lower dryer related damage and vastly improve your dryer management.

There are several competent seed dryer designers and builders that can assist you in your drying design. As this is a very high investment item, great care should be taken in the design and selection of the building and burner-blower units.

Shelling and Bulk Storage

There are three main causes for sheller damage:

a. Sheller speed too high.

b. Sheller not being kept full.

c. Seed is too dry and brittle.

Therefore, it is very important in any shelling operations to watch the following very closely:

a. Keep the sheller 100% full at all times.

b. Keep the shelling cylinder speed at a minimum for capacity needed or a maximum of 400 R.P.M. on a Triumph Sheller.

c. Have a good aspiration section.

d. Have a good cob removal system.

If the seed has not been over-dried and the above aspects have been observed, you can expect to have the lowest possible damage.

Prior to putting the seed into bulk storage, they should be pre-scalped to remove the large cob particles, light chaff and as many of the cracks and fines as possible. This is important because it can prevent storage damage from spoilage and heating as well as maximize use of storage space.

Again, the conveying system and storage bins should not cause damage, or contribute to contamination. Bulk storage units should have aeration for the best and safest storage. NEVER USE A SCREW CONVEYOR OR AUGER.

Cleaning and Sizing

There are seven steps in cleaning and sizing corn seed:

1. Cleaning

2. Width separation

3. Thickness separation

4. Length separation

5. Aspiration and gravity separations

6. Treating

7. Bagging

Again, we should keep in minds the design criteria of damage, contamination, application and maintenance.

Cleaning

A good air screen cleaner or scalperator should be selected depending on the type of job required.

Width Separation

The seed should be separated for width rather than thickness first as the width sizer (round hole) doesn't "care" if 80% of the seed is flat or round. With today's single cross production it is hard to say which you might get.

The screen sizes should be selected for the number of sizes being marketed and can vary depending on the size of the inbred seed and plantability.

Thickness Separation

Again, the screen size could vary depending on the inbred line and plantability.

Length Separation

It is important to length size most kernel sizes. In most sizes, depending on the variety and kernel type, a double length cut is recommended. Proper indent selection, before holding on each size or after holding one size at a time.

Aspiration and Gravity Separation

It is most important that each size be finished on a gravity separator for the best possible quality seed. For higher capacity the addition of an aspirator can triple capacity. This is accomplished by using the aspirator as a splitter. Run all the seed through the aspirator lifting, by air, approximately 20 to 25% of all the seed. This 20 to 25% is then run to the gravity for the finishing. The good seed from the aspirator and gravity are joined together to go to the treater.

Treating

A treater should be selected that will give you a complete and uniform treatment coverage. It also is important to select one that will not mechanically damage your seed.

Bagging and Warehouse

The bagging operation should be designed to fit all your needs with regard to capacity of the plant, as well as sales needs. Bagging is by weight; however, there are many companies marketing seed by kernel count as well.

Warehousing should be designed to give adequate space for palletizing the seed, for order make up and shipping, as well as storage.

If you are carrying seed over from year to year, consideration should also be given to a temperature and humidity controlled storage area for this seed.

Accessory Equipment

Other equipment needed in the sizing or conditioning operation include:

Conveyors - never use a screw conveyor or auger on good seed. We prefer the vibratory conveyor because it meets our design criteria; however, if the unit is mounted overhead, a belt conveyor will be less expensive and work as well.

Elevators - always select an elevator that is slow moving and a non-centrifugal discharge type for good seed quality handling. These elevators should also be equipped with plastic or polyethylene buckets, have at least 3/16" spacers between buckets and belt, and have either a bottom boot slide cleanout with 4" to 6" legs to elevate boot off the floor, or an automatic boot cleanout.

Spouting - all spouting should be smooth, without ledges, grooves, etc. to hold or contaminate seed. They should be at 45^{o} angle for self-cleaning and on long spouts should have a drop box to slow seed down without damaging (box must also be self-cleaning).

Discard System - screw conveyors are okay to use in this application; however, the system should be designed with the design criteria in mind, and we have found that a pneumatic system works very effectively.

Air and Filter Systems - be sure to check your particular state and local regulations regarding air emissions. This will determine if you can use a cyclone or must go to a filter system. If a dust collecting system is used this should be filtered, particularly in the northern areas, because of heating. If not filtered and returned to plant, all the heat is lost.

Make sure that all E.P.A. and O.S.H.A. regulations and requirements are met as well as all the National, State, and local codes. You should also check with your insurance companies regarding cost of insurance on different structures.

Summary

We must always keep in mind that we are working with a living product. Our goal is to keep it viable, vigorous and pure. Marketing of the highest quality and purest seed builds your company's reputation and sales.