April 2021

Harvesting and Drying Hybrid Seed Corn

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HARVESTING AND DRYING HYBRID SEED CORN

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Harvesting

The best germination and highest quality are obtained when the seed corn is harvested as soon as it is mature and dried as rapidly as possible to less than 14 percent moisture. When the moisture content of the seed corn in the field has reached 30-35 percent, it is mature and may be harvested without causing shrinkage of the kernels. The seed corn may be husked either by hand or with a mechanical corn picker. The husked corn should be moved rapidly to the drying bins to avoid over heating of the seed. The wetter the corn, the more likely over heating will occur, which may result in injury to the seed. Seed corn harvested early (25-30 percent moisture) will usually have less disease, insect, and weather damage than that harvested later. Also, the corn picker will more completely remove the husks from wet corn than from the dry.

Husking and Sorting

Husks not removed by the corn picker must be eliminated if uniform drying is to be accomplished. In addition, insect infested, diseased, and off-type ears should be removed prior to putting the seed in the dryer. These two operations may be performed at the same time by workers spaced along a moving belt leading from the point of unloading to the place where the seed enters the drying bins. A husking bed may be installed ahead of the sorting belt to remove many of the husks. The seed corn then passes into the drying bins.

Drying

In order to avoid losses and to insure high quality seed every year, large growers should have some kind of artificial drying equipment. If smaller growers cannot afford the installation of such, they certainly should have ready access to adequate dryers.

The function of drying seed corn is one of reducing the moisture content to less than 14 percent as rapidly as possible. The conditions necessary for rapid drying with heated air are a high temperature, a low moisture content of the drying air, and free movement of air about the corn. There is little the processor can do about the moisture content in the outside air, however, he can maintain the temperature of the heated air at 110° F. Even when using very moist outside air, raising the temperature increases its water holding capacity, thus enabling the heated air to take up moisture from the seed. Temperatures above 110° F. figure may damage the seed, while drying seed at lower temperatures is inefficient. Free and positive movement of the air about the corn may be accomplished with the proper type of fan having sufficient capacity to do the drying job demanded.

A good method of drying seed corn through the use of forced circulation is to force heated air directly through ear corn contained within solid-walled bins with slotted floors. This is called the bin method of drying and is very satisfactory.

To obtain good quality seed and economical drying, certain properties of the air must be kept within practical limits. The relative humidities of the drying air must be low enough to dry the corn to the desired moisture content. (Air with a relative humidity of 65 percent while passing through a bin of corn will not dry the seed below 13 percent moisture.) Low air velocities lengthen the time of drying while high velocities are inefficient.

As the air passes through a bin of corn, it is cooled as it picks up moisture. Therefore, the drying power diminishes as the air passes through the bin and thus establishes a maximum depth of corn which is practical to dry. An excessive depth does not allow the entire amount to dry in the desired time, while too shallow depth does not fully utilize the water holding capacity of the heated air.

The following values have been determined by many investigations in areas where the hybrid corn industry is highly developed. Slight local variations may be advisable but these specifications appear adequate.

Maximum temperature of drying air	110° F
Depth of corn in bin	6 feet
Volume of undried ear corn per bushel of shelled corn, for estimating size of bin	3½ cu. ft.
Volume of air required per minute per square foot of bin floor area, for selecting fan size (expressed differently as 10 cu. ft. of air per minute per cu. ft. of corn).	60 cu. ft.
Resistance pressure, for selecting fan size	1 to 1½ inches of water *

Heat required per square foot of bin floor area, for estimating net heater capacity **

	B. T. U.# per hr.
No re-circulation	3200
50 percent re-circulation	2200
75 percent re-circulation	1600

* A pressure of one inch of water is that pressure which will support a column of water one inch high. It is the unit of pressure commonly used in fan engineering. In this instance it is the pressure required to force the air through the corn and the duct work.

** Based upon a 50-degree temperature rise for fresh air and a 20-degree rise for re-circulated air.

\# British thermal unit.

The principle parts of a drying unit include one or more drying bins, a heating unit, a fan with a power unit to drive it and thermostatic controls. These are usually located with the fan between the heating unit and the drying bins.

Bins to be used for drying with forced heated air are constructed with solid walls and a false slatted floor and an opening at the top and at the bottom of the bin through which air may pass. It is essential that the bin walls and ducts as well as all joints be made tight to reduce air leakage to a minimum. In a multiple bin set-up the bins are usually arranged along one side of the air duct or they may be placed on both sides; they may be one floor deep or on two floors. There are a number of arrangements that may be used to fit particular circumstances.

The open slatted bottoms are usually constructed of 1 by 4 inch boards placed on edge and spaced one inch apart. They may be built in sections to facilitate removal when cleaning out the bins. Perforated metal floors are good if the perforations occupy close to 50 percent of the floor area. The slatted bottoms are placed about 18 inches above the bin floor. This provides an opportunity for the air to become fairly well distributed before passing through the corn. Often the floor is sloped in order to make removal of the ear corn earier.

Air may enter the bin from below the slatted floor by means of a door opening into the air duct and is exhausted through a topless bin or through a wide door in or near the top of a bin with a ceiling. However, by constructing a lower and an upper air duct and by the use of dampers and the proper manipulation of doors leading into the air ducts air may be passed downward through all bins, upward through some and downward through others, as well as upward through all. It is also possible to re-circulate part of the air through the bins.

Generally speaking, the size of the openings to the bins for the supply and the exhaust should be not less than 1/8 to 1/6 the area of the bin floor; however, it is suggested to follow the recommendations of the fan manufacturer when constructing air ducts and openings.

For proper drying, corn is usually placed 6 or 7 feet deep. Husks should be removed from the ear corn. Silks and trash should not be allowed to accumulate in one spot in the bin because air movement will be hindered and poor drying may result.

Many types of heating units burning almost any type of fuel may be used. A natural gas or butane heater especially designed for use in air ducts is perhaps best for southern areas. Heaters which allow the gases of combustion to pass through the bins along with the heat are the most efficient types and are satisfactory if the flame is relatively free of smoke. Also, with this type of heater, the need for a chimney is eliminated and the installation of the heating unit is simplified. The B.T.U.s required of a heater as given in the table above is based upon the assumed need of raising the temperature of the outside air 50° F as it passes through the bins six feet deep in corn at the rate of 60 cubic feet of air per minute per square foot of floor area.

The selection of a fan depends primarily upon (1) the cubic feet of air to be moved per minute, (2) the static pressure required to move the air at the desired rate through the bins of ear corn, (3) how the load may vary, which in turn depends upon how the other factors vary.

The capacity can be easily computed by consulting the table. Four bins each, having a floor area of 72 square feet, containing ear corn six feet deep, would require a fan capacity of 4 x 72 x 60 = 17,080 cubic feet per minute.

The total static pressure required to move air depends upon the amount of husks, silks, shelled corn, and other loose material, in addition to the ear corn. It also depends upon the velocity of the air, friction losses in the air ducts, and openings to and from the bins. At the recommended rate of air flow as given above, a total of 1 to 1¼ inches of water is usually required to move 60 cubic feet of air per square foot of bin area through ear corn six or seven feet deep. The centrifugal multiblade type fan is probably the most satisfactory type to use with bin dryers. These fans are of two types (a) forward curved and (b) backward curved. The forward curved fan is cheaper and requires less power than the other type and will deliver a large volume of air at a maximum air pressure of approximately 1¼ inches of water. Because of these characteristics, the forward curved fan is often used in drying ear corn. However, if the corn in the bin is to be considerably deeper than six feet, or if shelled grains are to be dried, the backward curved fan should be used since it will deliver a large volume of air under a much higher static pressure.

Belt driven fans are preferred over the direct drive, since by a proper choice of pulleys, the desired fan speed can be obtained. With a variable speed pulley on the motor, the fan speed may be reduced when only a portion of the drying bins are being used.

The power requirements of a fan depend upon its capacity against various resistances. The information can usually be obtained from the fan manufacturer. The power unit should have a margin of power to prevent over loading. With a drop in pressure, forward curved fans deliver a much greater volume of air. This results in an increased power requirement which may result in an overload on the motor unless the margin of power is great enough.

Since excessive temperatures will most certainly damage the seed and since low temperatures are inefficient in drying, adequate controls are essential. A thermostat is necessary if even temperatures are to be maintained. In addition, controls should be installed which will turn off the heater in case of fan failure. Continued operation of the heating unit in the absence of air movement could result in a fire, or damage to the seed through overheating. Controls should also be included which will insure continual running of the fan in event the heating unit fails. If the drying bins contain wet corn, lack of air circulation may result in overheated seed.