DRYING CROPS with a FLUE TOBACCO BARN

Drying Crops With a Flue Tobacco Barn

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A small drying plant is rapidly becoming a necessity on many North Carolina farms. Drying hay in the barn is an established practice and the number of these installations is increasing each year.

Hybrid seed corn driers have proved very practical and there are a number of such plants in the state. With this increase in knowledge of what can be done, farmers are asking for information on drying crops in general. In answer to such requests, the Agricultural Engineering Research Section, of the Agricultural Engineering Department, at State College, has found that certain crops can be safely dried in bins built under a shed, along one side of a flue tobacco barn.

Flue tobacco barns are not available on all farms, but they are in use over a large part of the state. They are heated with various fuels, but farmers are familiar with the operation of their own barn heating systems.

The research engineers have found that this system of drying crops works best with a coal stoker or an automatic oil burner, installed in, or in connection with the conventional tobacco barn furnace. This system of drying is not recomended for oil burners with open flames, or with those taking air for combustion from inside of the barn. Such burners have not proven satisfactory nor safe for the

forced air drying of crops. A hand-fired furnace can be used, but it requires very close attention.

How The Drier Works

Heated air is pulled by a fan from the tobacco barn and is forced into a heated air tunnel which is connected to the two drying bins. The flow of heated air from the tunnel into the drying bins is controlled by opening or closing gates. The gates release the air, under pressure, beneath the slatted floors of the bins. The slatted floors are essential for good drying because they provide space beneath the crop. The upward flow of heated air through the bins removes moisture from the crop, and in so doing, the air loses most of its heat.

What The Drier Will Do

From 750 to 1,500 bushels of wheat, oats, barley, grain sorghum, or soybeans can be dried by filling the bins three or four times in ten days; approximately 2,000 bushels of shelled corn, by filling bins seven times in three weeks; around 1,000 bushels of ear corn by filling the bins five times in three weeks; approximately 800 bushels of hybrid seed corn with three or four fillings of each bin in three weeks. It takes longer to dry hybrid seed corn because of its higher moisture content, when harvested early to combat insect damage. About 18,000 pounds of peanuts picked soon after digging, can be dried by filling bins five times in two weeks.

Installation Of Drier

Work Required Inside Barn

A false ceiling of asbestos cement board, or sheet metal is laid inside the barn on the bottom tier poles. Asbestos cement board is preferable. The ceiling should be made up of convenient size sections (say 4'x8'), so that it may be removed easily when the barn is to be used for curing tobacco. A 4" opening is left between the ceiling and the barn wall on the side opposite the fan. The ceiling must fit tightly against the walls on the other three sides of the barn and cracks between sections of ceiling should be made tight.

A fan is mounted in the wall of the barn on the side next to where the drying bins are to be constructed. The center of the fan should be approximately 4 ft. above the floor of the barn and mid-way between corners of the barn. The motor should be mounted on a platform resting on the lower tier poles. It must be so located that it can be belted directly to the fan. The fan and motor is described more completely below.

Provisions should be made so far as practical to stop all air leaks below the false ceiling. The lower ventilators will be closed when the drier is in operation. Air will enter the barn through the top ventilator, and will enter the heating area below the false ceiling through the 4" opening. As it is drawn through this area it will be heated by the hot flues and then forced into the hot air tunnel by the fan.

Hot Air Tunnels And Drying Bins

The hot air tunnel and drying bins must be protected by a shed. Once constructed, they are permanent fixtures and if a work shed for tobacco curing is needed, it should be built along one of the other walls.

Concrete Floor

A concrete floor, at least 4" thick should be poured for the drying shed. The length of the floor will vary for different barns. For example, it will be 16 feet long for a 16-foot barn. It should be 10'4" wide, and should be tight against the foundation wall of the barn. At the time of pouring, anchor bolts ½"x5", should be placed 4' on center, so that all sills for air tunnel and bins can be pulled tight against

the floor to eliminate air leaks, as well as to anchor walls in place. It is advisable to place a double thickness of building paper between sills and the concrete floor.

Building The Walls

The inside walls of the drying bins, from bottom to top, must be double boarded, with paper between layers of boards. The first layer of boards (sheathing) may be of matched lumber, but the second layer should be tongue and grooved. The layer of paper between the boards should be well lapped and tacked into place.

The same procedure should be followed in building the inside walls and ceiling of the hot air tunnel. This is required on the tunnel wall next to the bins to assure that hot air will not be lost through this wall when one bin is empty. An exception may be made on the barn wall within the tunnel, provided it is a very tight wall. If there seems any doubt about it, cover it well with a heavy paper.

The outside walls of the drying bins and the hot air tunnel should be covered with weather boarding, or a comparable outside wall. It is recommended that only dry lumber be used for constructing bins and hot air tunnel.

Air Gates

Study the details on the plan before installing air gates in the wall between the hot air tunnel and the bins. Remember the heated air must be forced through the contents of the bins. If gates do not fit tight, hot air will be lost through an empty bin. For air tight construction, sliding gates are far superior to hinged gates, and are easier to set and adjust to accurately control the flow of air.

Floors Of Drying Bins

Slatted floors, built of 1"x4" boards, made in sections approximately 2 ft. wide, are used in the bins. The details on the drawing clearly show how they should be constructed and supported. The length of the bins will vary for different barns; for this reason, slatted floor sections should be made to fit individual bins. The last section of slatted floor for each bin can be made just wide enough to fit into place.

For ear corn, no covering will be required on top of these floors, but for small grains, beans, and peanuts, extra covering is necessary. Perforated metal screens can be cut into

sections to exactly cover the slatted floors and these may be used year after year. If window screening is used, it is doubtful that it will last for more than a season.

Unloading Doors

The doors for unloading the bins present a major problem. They must be tight to prevent excessive air leakage, and yet they must be removable. When studying the detail on the drawing, be sure to note that the 1"x4" rider at the top of the door is not nailed in place. It closes the opening, but it is not attached to the unloading door. The "A" and "B" blocks are securely nailed to the door, so that it may be opened by forcing it to one side. If you prefer some other type door, remember it MUST BE AIR TIGHT, and you must be able to open it with the bin filled.

Fan And Motor

The proper movement of air through the crop in the drying bins is of utmost importance. The fan and motor is the heart of the system and must be carefully selected if satisfactory results are to be obtained.

A fan capable of building up the necessary air pressure and which will not overload the motor under any conditions should be used. The Crop Drying Table shows that the two critical points of air requirement are 2,000 cubic feet per minute, at 1.125 inch static pressure and 6,000 cubic feet per minute at 0.5 inch static pressure. Fans are available that will meet these requirements when operated by a one horse power motor. Two examples of such fans are: Aerovent, 24 inch, six blade propeller fan, with blades set at 16 degree pitch, and operated at 2,150 R.P.M.; Hartzell 24 inch, six blade propeller fan, operated at 1,700 R.P.M.

In ordering your fan be sure to specify the two critical points of air requirement, and that the fan is to be operated with a one horse power electric motor. Normally it is a good policy to order the motor from the same concern that furnishes the fan. This assures a matched unit, with proper pulleys and belt.

Since the fan must run at a different speed than the motor, it is necessary to drive the fan with a belt. For this purpose a "V" belt drive is most satisfactory.

A one horse power motor should always be operated from a 220 volt line. It is good insurance to install a motor

starting switch which provides protection against low voltage, or overloading of the motor.

All permanent wiring for the motor should be kept on the outside of the barn, but under the shed. An extension cord and plug should be used to carry power from an outside receptacle in to the motor.

Operating Instructions

With this system of drying crops the temperature of the air in the heated air tunnel should be kept at approximately 105 degrees F. Under no conditions should this air temperature exceed 110 degrees F. when drying crops to be used later for seed. Temperatures higher than 110 degrees are likly to lower the percentage of seed germination.

Air will flow more freely through some crops in the drying bins than it will through others. With the fixed system described, it is absolutely necessary to load the bins to the depth specified for each crop. To eliminate guesswork, lines should be painted around each bin at points, 3, 4, and 6 feet above the sloped floor. The proper depth to load bins for each crop will be found by referring to the Crop Drying Table.

Both bins may be loaded and dried at the same time, or one bin can be unloaded and loaded again while the other bin is in operation.

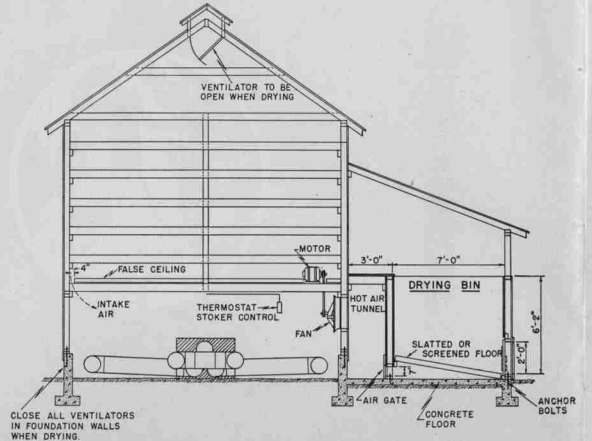
To start the drying process in a bin, open the air gate all the way. If both bins are loaded at the same time, both gates should be fully opened. For efficient operation the air gates should be lowered periodically. For example, while drying a crop that requires 4 to 6 days to dry, the air gate, or gates should be lowered to close one half the opening, every 24 hours. For a crop requiring 2 or 3 days to dry, the gate, or gates should be lowered every 12 hours.

A suggested way for unloading the bin is to spread a canvas on the ground directly in front of the unloading door. When the unloading door is opened the crop will flow out onto the canvas.

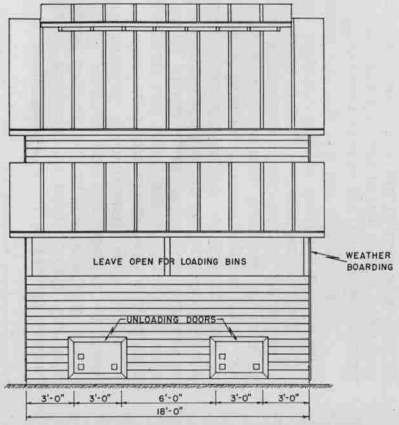
Bins should be swept clean after unloading. Any material that collects beneath the sloped floor should be cleaned out several times during the season.

When the barn is to be used for curing tobacco the fan and motor should be removed and stored in the heated air tunnel. The fan opening should be closed with asbestos board, plywood, or tongue and grooved boards.

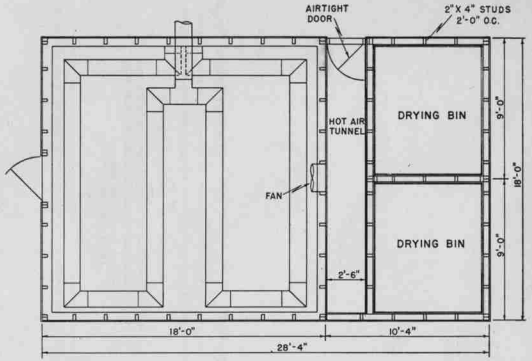
TRUCTION INSIDE



SECTION THROUGH BARN & DRYING BIN
SCALE: 1/4" = 1'-0"



SIDE VIEW OF BARN & DRYING BINS
SCALE: 1/4" = 1'-0"



FLOOR PLAN
SCALE: 1/4" = 1'-0"

CROP DRYING TABLE

CROP	AIR NEEDED FOR BOTH BINS (CU. FT./MIN.)	STATIC PRESSURE* (INCHES OF WATER)	RECOMMENDED DRYING AIR TEMP. (DEGREES F.)	MAXIMUM DEPTH OF CROP IN BINS (FT.)	LENGTH DRYING SEASON (DAYS)	TIME REQUIRED TO DRY A BIN (DAYS)	NUMBER FILLINGS FOR EACH BIN	TOTAL CAPACITY FOR THE SEASON
CORN (EAR)	4000	0.5	90 TO 110	6	21	3	5	1000 BU.
CORN (SHELLED)	2000	0.5	90 TO 110	4	21	2 1/2	7	2000 BU.
CORN SEED HYBRID (EAR)	6000	0.4	100 TO 110	6	21	4 TO 6	3 TO 4	800 BU.
WHEAT	2000	1.125	100 TO 110	3	10	2 1/2	3	750 BU.
OATS	2000	1.0	100 TO 110	4	10	2	4	1350 BU.
BARLEY	2000	1.0	100 TO 110	4	10	2	4	1350 BU.
GRAIN SORGHUM	2000	1.0	90 TO 110	4	10	2	4	1350 BU.
SOY BEAN	2000	0.5	90 TO 110	4	10	2	4	1350 BU.
PEANUTS	6000	0.5	90 TO 110	3	14	2 1/2	5	18000 LBS.

*STATIC PRESSURE, IN THIS CASE, IS THE PRESSURE NEEDED TO FORCE AIR UP THROUGH CROP

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TOBACCO BARN CROP DRIER

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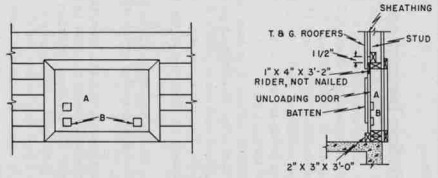
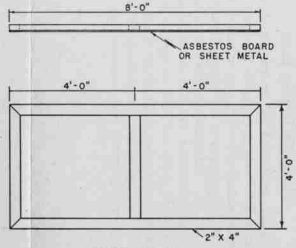
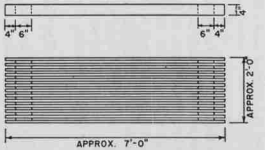


UNLOADING DOOR DETAILS

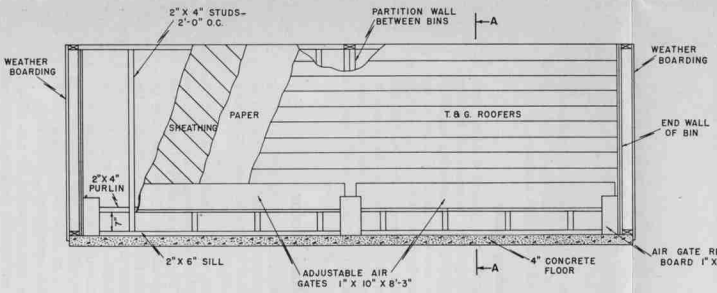
NOTE: TO OPEN DOOR, RAISE B BLOCKS UNTIL BOTTOM OF DOOR IS CLEAR. SLIDE A BLOCK TO RIGHT OR LEFT UNTIL DOOR OPENS.



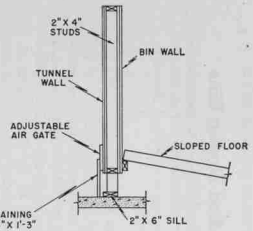
FALSE CEILING
DETAILS OF ONE REMOVABLE SECTION



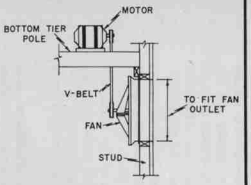
DETAILS OF SLOPED FLOOR
WITHOUT PERFORATED METAL OR
SCREEN WIRE COVERING



INSTALLATION OF AIR GATES
& CONSTRUCTION OF REAR WALL OF BINS
(LOOKING AT WALL FROM HOT AIR TUNNEL)



SECTION A-A (CROSS SECTION
OF AIR GATE & REAR WALL OF BIN)



PRESSURE TYPE FAN

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TOBACCO BARN CROP DRIER

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