



ENERGY CONSERVATION IN AGRICULTURE

COOPERATIVE EXTENSION SERVICE/THE UNIVERSITY OF GEORGIA/COLLEGE OF AGRICULTURE/ATHENS

CUT ENERGY COSTS IN TOBACCO CURING

Approximately 80 percent of Georgia's 1980 tobacco crop was bulk cured. More than 9,000 barns were required to cure the 53,625 tons of tobacco. This publication points out ways these barns can be operated more efficiently, thus saving producers a tremendous amount of fuel and money.

Two basic bulk curing barns are available—the down-draft barn and the up-draft barn. In the down-draft barn, the furnace delivers heated air into the attic space or top plenum. It passes through the tobacco and is returned to the furnace in a bottom plenum formed by the barn foundation and the concrete slab. In the up-draft barn, the delivery plenum is at the bottom and return plenum is at the top.

Bulk curing barns are either mobile or permanent. Mobile style barns are manufactured as a complete unit, much like a mobile home. They are placed on a concrete slab at the farm site; the fuel and electric power connections are made, and they're ready for operation. Plans for permanent bulk curing facilities are also available to the producer who wishes to build his own. Regardless of the type of barn used, proper management of the curing process and the barn can reduce energy use.

THE CURING PROCESS

The temperature and type of venting schedules used will affect the amount of energy used during the curing process. The physical and chemical changes which occur during different phases of the curing cycle and optimum environmental conditions for each phase are as follows.

Yellowing Phase

The purpose of the yellowing phase is to continue biological changes in the leaf, such as starch-to-sugar conversion, oxidation and disappearance of chlorophyll, and protein simplification. The curing environment which should be maintained in the barn during this phase is: (1) Temperature should start at 95°F. and go to 105°F. at 1° to 2°F. per hour. (2) The barn should be vented to maintain a wet bulb temperature of 93° to 97°F.

The ideal process in this phase would be to remove as much moisture from the leaf as possible without setting the incorrect color. This, however, is a risky process and for safety reasons, one should exchange only a small amount of air in the yellowing phase. Leaf coloring usually takes 48 to 72 hours, depending on the condition of the tobacco when curing begins.

Leaf Drying Phase

The leaf drying phase consists of two processes—wilting and color fixation. These are to arrest the coloring processes at the right time and to preserve leaf quality. The tobacco leaf at this time is very sensitive to temperature and moisture content, which can cause browning or discoloration. At a given moisture content, the rate of browning increases directly with temperature. Complete discoloration can occur within minutes at a barn temperature of 135°F. At any given temperature, the rate of browning is highly influenced by moisture content. Ventilation of outside air into the barn should increase during this phase to maintain proper wet bulb temperature. Time is required for moisture removal to keep up with temperature increases. If the tobacco gets too hot, water scalding or sweating will occur. For minimum tobacco discoloration, the temperature must be increased slowly (1°-2°F. per hour). The leaf drying phase temperature should go from 105° to 135°F. Wet bulb temperature should go from 97° to 105°. Leaf drying usually takes 48 to 72 hours or until the leaf is dry.

Stem Drying Phase

After the leaf is essentially dry, the barn temperature should be raised gradually (2° to 3°F. per hour) to 165°-170°F. This gradual rise in temperature allows final leaf drying without sponging or scalding. The exchange of outside air should be decreased during this phase. Caution should be taken to not let the temperature exceed 170°F. during stem drying. The sugars in tobacco will begin to caramelize, and the leaves will turn red at excessively high temperatures.

Figure 1 shows a suggested bulk curing schedule. The times can change according to condition of the tobacco when it begins the cure. Factors which affect time required for curing in certain phases are maturity of tobacco, stalk position of the leaf, the use of ripening agents and weather conditions at harvest.

BARN MAINTENANCE

Barn maintenance is essential for energy conservation. Caulking compound for structural cracks and new weather stripping for doors cost but a trifle compared to the energy they save.

Thermal Insulation

Insulation of a conventional bulk tobacco barn can save 45 percent of the heat lost in an uninsulated barn. With fuel prices at \$1.00 per gallon, time required to pay for insulating is approximately two years.

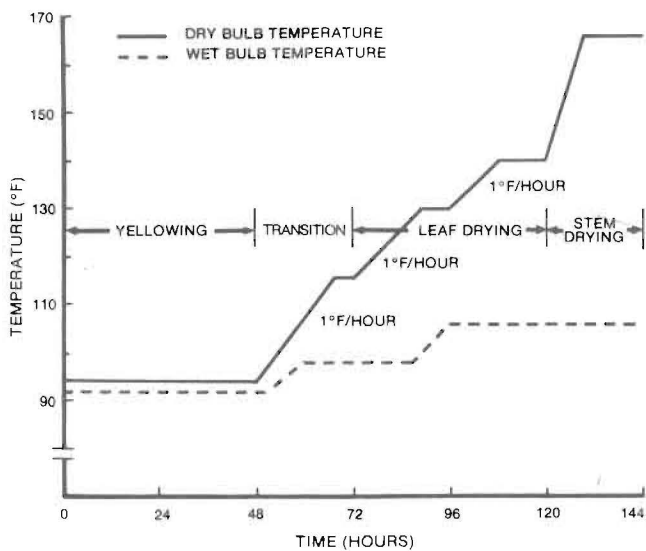


Figure 1. Suggested tobacco bulk curing schedule.

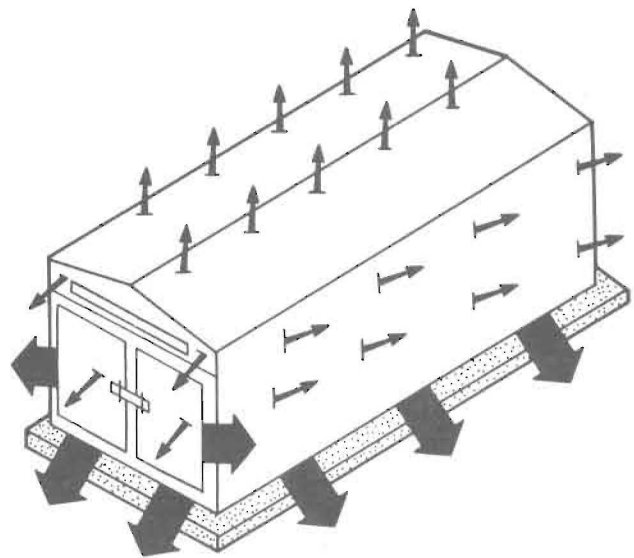


Figure 2. Air losses through cracks and heat losses through an uninsulated building may waste more than 100 gallons of fuel per cure.

Roof Insulation

As more insulation is incorporated into the roof, the energy required for heating decreases. Adding 1.5 inches of polystyrene board or 6.0 inches of fiberglass on the underside of the roof decreases heat losses through the roof by 74 percent.

Wall Insulation

Inserting 1.5 inches of polystyrene board into walls and doors reduces heat losses through them by 55 percent.

Slab Insulation

Insulation under a concrete slab of 1.5 inches polystyrene reduces heat losses through the slab by 80 percent.

RECOMMENDATIONS

Stop Hot Air Leaks

Check door gaskets and structural cracks. Even a small crack in the lower or pressure side of a bulk barn loses large quantities of heat. In many instances, air leaks between the barn walls and the concrete pad or foundation go unnoticed. A ¼-inch crack 15 feet long between the pad and building may cause a loss of as much as 10 percent of air and heat.

Ventilate Only Enough to Hold Humidity Down

The wider the vent opening, the more fuel required. Open the vent or fresh air damper only enough to hold humidity down to the proper level (97° to 105°F. wet bulb temperature during leaf drying and 105° to 110°F. wet bulb temperature during stem drying).

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AN EQUAL OPPORTUNITY EMPLOYER

EC 4-1 Tobacco

Circular 730

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, The University of Georgia College of Agriculture and the U.S. Department of Agriculture cooperating.

Tal C. DuVall, Director

Cost: \$250.00/Quantity: 10M
UPD 5657/5-81

Add Insulation

Well-insulated walls, roof and floor may save as much as 75 gallons of fuel per cure.

Load Racks or Boxes Uniformly

Uniform loading with no "tight spots or loose spots" assures even drying, better quality, quicker "kill out" and less energy use.

Assure an Air Seal Around Each Rack or Box

A small crack between boxes or racks reduces ventilating efficiency to a surprising degree. Research has shown that a crack ½-inch wide between boxes reduces ventilating efficiency by 50 percent. That is, half the air goes through the crack and half goes through the box of tobacco.

Tune Up the Fuel Burner

Both oil and gas burners require periodic maintenance and adjustment for efficient operation. Fuel dealers usually have the proper instruments and know-how for this job.

Harvest Only Ripe Tobacco

Shorter curing times mean less heat loss and more efficient curing.

SUMMARY

Stopping those unnecessary leaks around doors and concrete slabs, using a wet bulb thermometer and choosing the most efficient curing schedule will reduce energy consumption and save money.