FARM BUSINESS MANAGEMENT

FARM ECONOMICS Facts & Opinions

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November 29, 2001 **FEFO 01-23**

CORN AS A NON-ETHANOL HEATING FUEL SOURCE

As a result of recent low corn prices and high propane prices, there has been increased interest in the use of corn as a heating fuel. Corn burning stoves and furnaces have been available for many years. Current technology has improved the efficiency of corn burning; hence, corn burners are becoming more economical. Corn burning stoves and furnaces feed corn from a holding bin into a firepot where the corn is burned and a small electric fan provides air for combustion. In general, corn-burning stoves heat one room. Corn burning furnaces have the ability to heat an entire house by using a heat exchange system somewhat similar to gas furnaces.

Heat from Alternatives

Heat available from a fuel source depends on the BTUs available from the fuel source and the heating systems efficiency. A BTU, or British thermal unit, is scientifically defined as the amount of energy needed to raise the temperature of one pound of water one degree Fahrenheit. The BTU is a nationally accepted standard of measuring the heat content of fuel.

BTUs produced from various sources are shown in Table 1. A bushel of shelled corn produces 352,800 BTUs. This compares to 91,500 BTUs from a gallon of propane. A bushel of corn has almost the same potential energy as four gallons of propane.

Table 1. Fuel Prices and BTU Values

Fuel Type	Fuel Price Per Unit	Btu's per Unit of Fuel
Shelled Corn	$2.00	352,800 BTUs per Bushel (or 6300 BTUs/pound)
Propane	$1.72	91,500 BTUs per gallon
Natural Gas	$1.20	100,000 BTUs per Therm
Kerosene	$2.79	127,000 BTUs per Gallon
Electricity	$0.06	3,413 BTUs per kilowatt-hour

Oil	$2.45	140,000 BTUs per gallon
Hard Wood	$180.00	20,790,000 BTUs per full cord

Source: **American Society of Heating, Refrigeration, and Air-Conditioning Engineers**

The number of BTUs actually produced into usable heat depends on the efficiency of the furnace. Today's gas and oil burning furnaces are all rated on a federally mandated efficiency standard. After mandated testing, each furnace is labeled with its Annual Fuel Utilization Efficiency, termed A.F.U.E. The higher the A.F.U.E., the more efficiently the furnace will heat your home. Since the early 1980's furnaces have been available with A.F.U.E. ratings ranging from approximately 80% to 98%, compared to older well-maintained furnaces with annual efficiencies of only 55% to 65%. A.F.U.E. ratings do not consider heat loss from ducts. Duct losses can range from near zero, for homes with ducts located within the heated space, to as high as 30% or more.

Geothermal heat pumps have seasonal efficiencies up to 300 percent. Heat pumps are able to provide efficiencies greater than 100% because heat pumps move heat, instead of releasing heat through a burning process as is done in furnaces and boilers. Electricity is used to run a heat pump's compressor motor. For every one unit of electricity that the motor uses, more than one unit of heat can be captured and moved by the refrigerant that is being pumped through the heat pump's coils.

Comparing operating costs from different heating sources

Heating costs per million BTUs can be calculated by knowing the price of the fuel, BTUs from the fuel, and the seasonal heating efficiency. The cost per million BTUs ($/MMBTU) equals:

(1,000,000 x price of fuel) / (BTUs per unit of fuel x system seasonal efficiency)

Costs for alternative heating sources are shown in Table 2. Fuel prices and BTUs used in the calculations are shown in Table 1.

Table 2. Costs per Million BTUs ($/MMBTU) for Alternative Heating Sources

Type of Fuel and Type of Heating System	System Seasonal Efficiency	Cost ($/MMBTU)
Geothermal Heat Pump	300%	$5.86
Shelled Corn Burner	70%	$8.10
Air to Air Heat Pump	200%	$8.79
Natural Gas Furnace	90%	$13.33
Natural Gas Furnace	80%	$15.00
Whole House Electric Furnace	100%	$17.58
Natural Gas Furnace	65%	$18.46
Propane Furnace	90%	$20.89

Oil Furnace	80%	$21.88
Kerosene Portable Heater	95%	$23.12
Electric Portable Heater	100%	$23.44
Propane Furnace	80%	$23.50
Oil Furnace	65%	$26.92
Propane Furnace	65%	$28.92
Wood (Improved Fireplace)	20%	$43.29
Wood (Standard Fireplace)	10%	$86.58

Seasonal efficiencies are accepted industry norms.

For fuel prices shown in Table 1, burning corn in a shelled corn burner is relatively cost efficient. A shelled corn burner has an $8.10 cost per MMBTU. Only a geothermal heat pump has a lower cost. Burning propane in a 90 % AFUE furnace has a $20.89 cost per MMBTU. Thus the heating cost with a shelled corn burner is less than a 90 percent efficient propane furnace.

How well corn burning compares depends on fuel prices. Table 3 shows breakeven propane prices for various prices per bushel of corn. If corn were priced at $2.00 per bushel, then the equivalent price for propane used in a 90% AFUE furnace would be $0.67 per gallon. Or if you have an older type unmodified propane furnace with an estimated seasonal efficiency of 65%, you would need to be able to buy propane for only $.48 per gallon to get an amount of heat equal to $2.00 corn used at 70% seasonal efficiency.

Table 3. Breakeven Propane Prices for Different Corn Prices.

	CORN	Versus	PROPANE		
	Efficiency		Efficiency	Efficiency	Efficiency
	70%		65%	80%	90%
Cost/Bushel	$ 1.75	Equivalent Cost/Gal. of Propane	$ 0.42	$ 0.52	$ 0.58
Cost/Bushel	$ 2.00	Equivalent Cost/Gal. of Propane	$ 0.48	$ 0.59	$ 0.67
Cost/Bushel	$ 2.25	Equivalent Cost/Gal. of Propane	$ 0.54	$ 0.67	$ 0.75
Cost/Bushel	$ 2.50	Equivalent Cost/Gal. of Propane	$ 0.60	$ 0.74	$ 0.83
Cost/Bushel	$ 3.00	Equivalent Cost/Gal. of Propane	$ 0.72	$ 0.89	$ 1.00
Cost/Bushel	$ 3.50	Equivalent Cost/Gal. of Propane	$ 0.84	$ 1.04	$ 1.17
Cost/Bushel	$ 4.00	Equivalent Cost/Gal. of Propane	$ 0.96	$ 1.19	$ 1.33
Cost/Bushel	$ 4.50	Equivalent Cost/Gal. of Propane	$ 1.08	$ 1.33	$ 1.50

Now using this information let's look at some estimated annual heating costs for a home. In central Illinois it would be reasonable for an 1800 square foot house to use 71,500,000 Btus (71.5 MMBtus) of heating energy during a typical heating season. The table below indicates various annual heating costs for this hypothetical home.

Costs for a typical home of 1,800 square feet that uses 71,500,00 BTUS of heating energy are shown in table 4. There are great variations in the cost of heating a home. Mainly the price of fuel and the seasonal efficiency of the heating system cause the cost difference.

Summary

At the annual fuel prices indicated above, operating costs for burning corn are less than many other heating sources. However, operating costs depend on fuel prices, which can vary considerably. Operating cost comparisons for burning corn are also favorable at a $2.40 per bushel, the average price of corn over the past twenty years.

This information does not consider the fixed costs associated with buying or maintaining a heating system. These costs will vary considerably across the alternatives. A complete analysis prior to switching heating sources and/or furnaces should include an examination of the costs of buying and maintaining complete heating systems, as well as the cost fuel.

Table 4. Typical Annual Heating Costs

Type of Heating System	Efficiency	Annual Heating Cost	Est. cost/unit of fuel
Geothermal Heat Pump	300%	$ 419	6 cents/kWh
Shelled Corn Burner	70%	$ 579	$2.00/bu.
Air to Air Electric Heat Pump	200%	$ 628	6 cents/kWh
Natural Gas Furnace	90%	$ 953	$1.20/therm
Natural Gas Furnace	80%	$ 1,073	$1.20/therm
Electric Furnace	100%	$ 1,257	6 cents/kWh
Natural Gas Furnace	65%	$ 1,320	$1.20/therm
Propane Furnace	90%	$ 1,493	$1.72/gallon
Oil Furnace	80%	$ 1,564	$2.45/gallon
Kerosene Portable Heater	95%	$ 1,653	$2.79/gallon
Electric Portable Heater	100%	$ 1,676	8 cents/kWh
Propane Furnace	80%	$ 1,680	$1.72/gallon
Oil Furnace	65%	$ 1,925	$2.45/gallon
Propane Furnace	65%	$ 2,068	$1.72/gallon
Wood (Improved Fireplace)	20%	$ 3,095	$180.00/cord
Wood (Standard Fireplace)	10%	$ 6,190	$180.00/cord

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