The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

Alternative Heating System Study - Heating Costs Analysis

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For the past 18 months extension engineers and poultry scientists from the University of Georgia as well as an engineer from the Georgia Forestry Commission have been studying a fairly typical hot-air alternative heating system on a commercial broiler farm in Northeast Georgia. A significant portion of the first year of the study was spent on optimizing the hot air distribution systems, modifying the furnace so that it could burn a wider variety of fuels, improving the control of the fuel combustion process, and increasing overall system reliability as well as ease of use. With these issues addressed, the study has entered the second phase; comparing the actual cost of heating a house with wood products to those using a traditional propane heating system.

Table 1 provides a basic description of the four 40' X 500' broiler houses being used in the study. A more detailed description of the hot air alternative heating systems as well as the houses can be found in the February, 2009 edition of *Poultry Housing Tips*. Tables 2 and 3 provide an overview of fuel usage and overall heating costs for two cold weather growouts. Figures 1 and 3 are graphs of average daily temperatures for the two growouts. Figures 2 and 4 are graphs of the total daily heating costs (propane and wood pellets/chips) for the two growouts.

	House 5	House 6	House 7	House 8
Side wall construction	one totally enclosed side wall, one with 2' tall curtain	one totally enclosed side wall, one with 2' tall curtain	one totally enclosed side wall, one with 2' tall curtain	one totally enclosed side wall, one with 2' tall curtain
Propane heating system brooding end	12 radiant brooders (3 zones)	12 radiant brooders (3 zones)	12 radiant brooders (3 zones)	12 radiant brooders (3 zones)
Propane heating system nonbrooding end	2 forced air furnaces	2 forced air furnaces	2 forced air furnaces	2 forced air furnaces
Alternative heating system	Biofiber Solutions BFS-500A	-	-	Biofiber Solutions BFS-500A
Wood fuel type	wood chips	-	-	wood pellets
Alternative heating system hot air distribution system	Short duct with 16" 1/5 hp circulation fans	-	-	Perforated duct which runs the length of the house

Table 1. House and heating system description.

November 21 - December 28, 2008				
	House 5 wood chips	**House 6 propane**	**House 7 propane**	**House 8 wood pellets**
Propane (gallons)	113	441	583	36
Propane cost @ $2/gal	$226	$882	$1,166	$72
Total wood fuel used (pounds)	11,916	-	-	15,848
Total wood fuel used (cubic feet)	993	-	-	396
Wood cost @ $50 per ton of wood chips @ $150 per ton of wood pellets	$300			$1,189
Peak 24 hour wood usage (pounds) ½ house	1,000	-	-	1,100
Peak 24 hour wood usage (pounds) full house	1,100	-	-	1,600
Total heating cost	$526	$882	$1,166	$1,362
Corrected heating cost	$526	$1,151	$1,926	$1,362
Savings	$625			$564
% Savings	54%			30%
Downtime (total hours)	12			14
Downtime (incidences)	1			1
Approximate overall heating system efficiency	55 - 60%			55 - 60%

Table 2. Flock heating costs

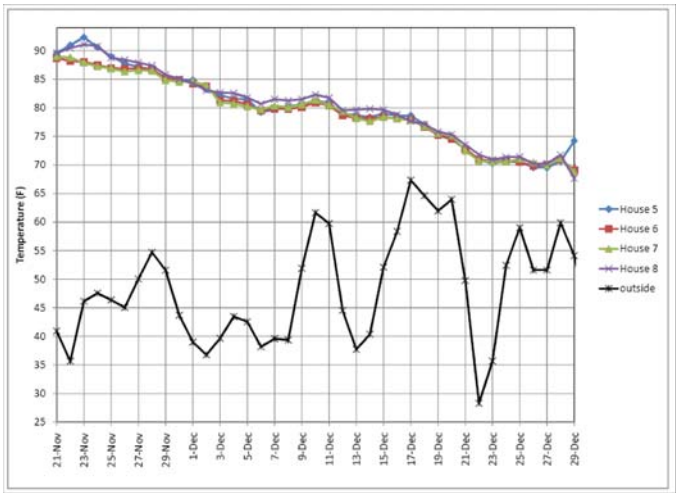


Figure 1. Average daily temperatures

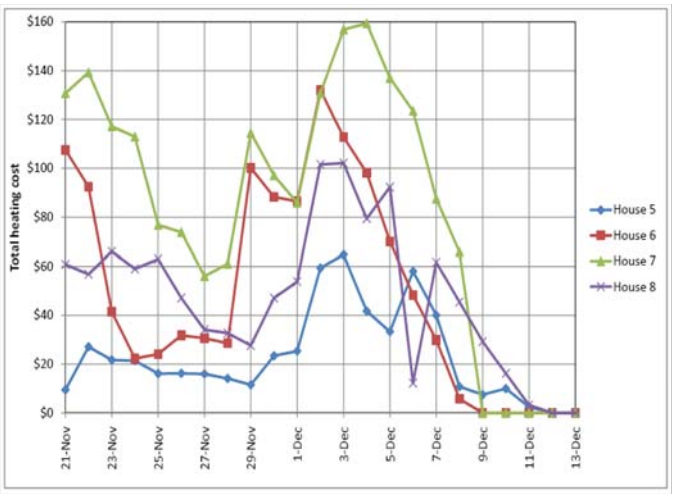


Figure 2. Total daily heating cost

January 26 - March 4, 2009				
	House 5 wood chips	**House 6 propane**	**House 7 propane**	**House 8 wood pellets**
Propane (gallons)	76	467	389	80
Propane cost @ $2/gal	$152	$934	$779	$160
Total wood fuel used (pounds)	8,110	-	-	6,570
Total wood fuel used (cubic feet)	680	-	-	164
Wood cost @ $50 per ton of wood chips @ $150 per ton of wood pellets	$203			$492
Peak 24 hour wood usage (pounds) ½ house	850	-	-	700
Peak 24 hour wood usage (pounds) full house	1,148	-	-	1,005
Total heating cost	$355	$934	$779	$652
Savings	$579			$127
% Savings	62%			16%
Downtime (hours)	20			13
Downtime (incidences)	2			2
Approximate overall heating system efficiency	65 - 70%			60 - 65%

Table 3. Flock heating costs

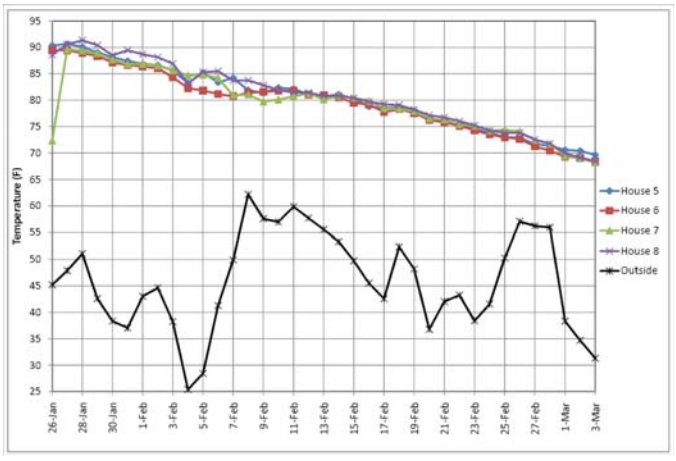


Figure 3. Average daily temperatures.

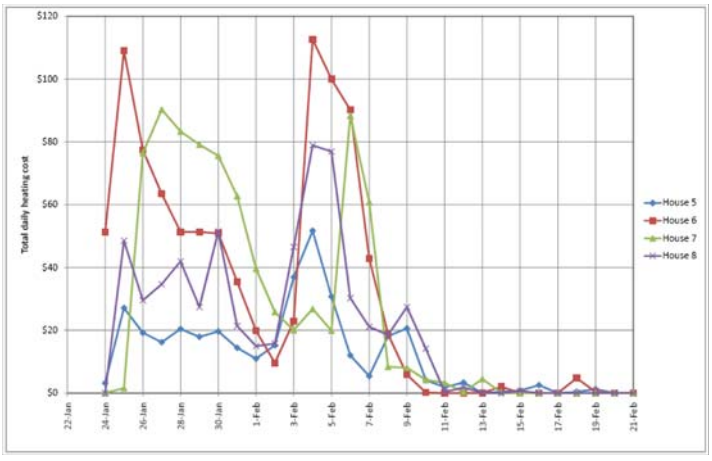


Figure 4. Total daily heating cost

November 21 - December 28, 2008 Flock:
Houses #5 and #6 were built at a different time than houses #7 and #8. Though they are all constructed very similarly, historically fuel usage in house #5 tended to be similar to house #6 while fuel usage in house #7 tended to be similar to house #8. As a result fuel usage in house #5 was compared to house #6 and house #7 was compared to house #8.

The alternative heating systems ran very well with a minimum of problems. Nighttime temperatures during the first week of the flock were below 20 degrees for the first few days and the alternative heating systems in both test houses were capable of maintaining proper brooding temperatures with essentially no assistance from the houses' radiant brooders. There was one incidence in each house where the burner failed to ignite the fuel. The failures occurred at night and weren't corrected until the next morning. House temperatures did not suffer due to the fact that the propane heating systems served as backups.

The actual fuel savings were less than expected due to an improper house environmental controller setting which resulted in the inadvertent over-ventilation of both the test houses for most of the study period. This incident illustrated well the potential loss in fuel savings that can occur when differences in the way an hot air alternative heating system heats a house compared to conventional propane systems are not taken into account (see February, 2009 *Poultry Housing Tips*). Since total fan operating time was being monitored in all the houses, heating costs for the two houses equipped with traditional propane brooders were calculated had they been ventilated at the same rate as the two houses equipped with the alternative heating systems.

The study farm historically has relatively low heating costs. This is likely due to the fact that the houses are well insulated (there is only a small yet tight curtain on one side of each house), are equipped with tunnel doors, radiant brooders, circulation fans, a modern environmental controller; and use a litter treatment to control ammonia during brooding. As a result of these efficiencies, although the alternative heating systems reduced heating costs 54% and 30% in the wood chip and wood pellet alternative heating systems respectively, the producer only saved (corrected for differences in ventilation) $625 and $564 respectively.

January 26 - March 4, 2009 Flock:
As with the first cold weather flock, the alternative heating systems ran very well. The four incidences when the alternative heating systems failed were either due to fuel ignition or auger problems. It is important to realize that the alternative heating systems were used for the entire flock. If at any time over the flock the environmental controller called for heat, the wood furnaces would automatically ignite the fuel and start heating the house with no work on the farm manager's part. If the fuel didn't ignite, the unit would attempt to start three more times before shutting down and sending an alarm. Once the heat was no longer required, the heating units would shut off until heat was required again which could be anywhere from a few minutes to a week later. So, even though there were a couple of ignition failures, the fact is that the alternative heating systems successfully started on their own well over 99% of the time.

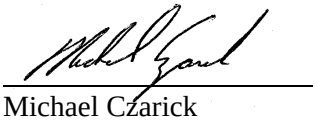
Changes made to environmental controller settings eliminated conflicts between the controller and the alternative heating systems and as a result there wasn't a problem with over ventilation in the test houses like that experienced during the first cold weather flock. Heating costs were reduced in the house burning wood chips by approximately 60% and 16% in the house burning wood pellets.

Each of the two houses equipped with an alternative heating system burned approximately 80 gallons of propane. Approximately 75% of the propane usage was for the pilot lights on the radiant brooders. The other 25% was used due to heat distribution issues or during times when the alternative heating systems failed to start.

As discussed in last month's *Poultry Housing Tips*, the key to the success of an alternative heating system is the delivered cost of the fuel burned. The wood chips that were used in the alternative heating system in House #5 were not only inexpensive but were relatively dry (12% moisture) which made them a very good fuel choice. Though the wood pellets are technically a superior fuel due to their lower moisture content (less than 10%), higher heat content per pound, and ease of handling, their relatively high cost (per Btu) made their use less financially viable. This is not to say that wood pellets cannot be a cost

effective fuel for use in heating poultry houses. It is possible that the circulation fan system used in the house burning the wood chips was more effective at delivering heat throughout the house and therefore contributed to the lower overall heating cost when compared to wood pellets. Had a different, more efficient heat delivery system been installed, or a different more efficient biomass furnace been used (somewhat doubtful due to the fact that preliminary testing indicated a burning efficiency of roughly 90%) the cost effectiveness of using pellets as a fuel would have been increased. But, the fact remains that, in general, the lower the delivered cost of the fuel (per Btu produced) the more cost effective an alternative heating system will be.

It is important to note that not only were heating costs reduced in the houses equipped with the alternative heating systems but there were also significant differences in litter and air quality which should lead to increased bird performance. These differences will be discussed in more detail in future issues of *Poultry Housing Tips*.



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