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NEBRASKA'S MOF AND SOLAR HEATED FARROWING HOUSES

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SWINE DAY

Successful operation of multiple Nebraska solar-heated modified-open-front (MOF) nursery/grower buildings led two producers to investigate use of the monoslope Nebraska MOF style building for farrowing. (The first Nebraska solar-heated MOF nursery/grower unit has been in continuous operation since October 1979.) Both units began operation in August 1984.

Installation No. 1

This unit is located on the farm of Sid and Tim Burkey, Dorchester, NE. The 14-sow facility features elevated crates with woven wire floors. An undercrate fresh water flush system is used for manure removal. Non-mechanical ventilation is used throughout the year. A combination manual-mechanical (thermostat control) system is used to adjust ventilation panel openings. Heat is provided by an unvented heater positioned at one end. Sows are weaned away from the pigs at 3-3 1/2 weeks of age. Pigs are moved to the nursery at 4-4 1/2 weeks of age.

Initially, creep heat was provided by a 250-watt (w) heat lamp (one per crate) equipped with a reflector. The deficiencies of that system quickly become evident. After trying several alternative hover designs, creep boxes were constructed. These units measure 7 ft. x 18 in. x 24 in. high and are centered between crates in alternate creep areas. A partition at mid length divides the creep box into two smaller boxes--one for each crate. Pig access is provided by one 8 in. wide x 10 in. high opening per unit. A 2 ft. length of each top is hinged to facilitate observation of and access to pigs. The original heat lamps have been replaced with 125-w heat lamps for the first week, 100-w light bulbs the second week and 60-w bulbs the third week, significantly reducing electrical energy useage. Drip coolers are used in warm weather for improved sow comfort.

Meters to monitor electrical and propane useage were not installed until Fall 1984. A kWh meter was installed November 1, 1984 and measures all electrical inputs to the building including lights in the farrowing and adjoining breeding/gestation unit and an air compressor to operate the ventilation panels. A total of 4340 kWh were used from the date of installation through September 10, 1985, 25% of which is estimated to be close to lights and air compressor operation. A propane meter was installed on the tank on November 5, 1984. A total of 141.3 gallons of propane were used from that date through September 10, 1985.

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With electricity at 7¢/kWh and propane at 65¢/gal. the result is a total cost of $392.82 for approximately ten months operation, including lights and air compressor. This compares with expenditures of over $900 to heat this producer's conventional 14-sow farrowing house during the same period. Data are not available regarding electrical energy use in the mechanically ventilated conventional unit. Precice construction costs are not available because of the combination farrowing and breeding/gestation unit but our best estimate is $1200 to $1300 per sow space.

Analysis of pig performance data is not complete. However, 21-day weights are approximately 5% higher than in the conventional farrowing house while mortality is about 5% lower. Both measures of performance improved after installation of the creep boxes. Pig weight at 21 days is typically 12-14 lbs.

<u>Installation No. 2</u>

This installation is on the farm of Art and Doug Paus, Fairfield, Nebraska. The building is divided into two 18-sow rooms, one on either side of a central service room. Sows are housed in 5 ft. x 7 ft. pens with total woven wire floors and an under-pen fresh water flush system. In addition to space beneath or behind guard rails on three sides of the pens, pigs have access to a 5 ft. x 2 ft. x 30 in. high creep box across the front of each pen. Pig access to the creep boxes is provided through two 8 in. x 10 in. openings--one at each end of the box or each side of the sow pen. Slide shutters are used to confine pigs to the creep boxes for the first few hours post-farrowing to aid drying without chilling and reduce the risk of death by crushing. These same shutters are used to confine pigs for treatment. The tops of the creep boxes are removable to allow access to pigs.

Heat in the creep boxes is provided by in-floor solar heated air and by heat lamps or light bulbs. The solar system consists of a closed-loop ground-level active collector across the front of each room to heat air, insulated PVC pipes to convey air from the collector to the floor and from the floor back to the collector, and an in-floor distribution system. During construction 2-core 8-in. concrete blocks were positioned side-by-side below the creep boxes. Block cores were aligned to form air passageways. Insulation the full width of the creeps was placed beneath the blocks. Vertical pieces of insulation extend up to the bottom of the concrete floor. The blocks were positioned low enough to allow installation of a 6 to 7 in. layer of sand over the blocks and below the concrete floor. The sand layer provides storage mass to allow carry-over of midday heat, helps to moderate floor temperature variations associated with collector fan operation, aided in establishing the desired floor level and permitted installation of an auxiliary warm water heating system. Air is moved through the solar system by centrifugal fans located in the central service area. Each farrowing room is independent with respect to heating system, flushing and ventilation. Water for the auxiliary heating system is warmed by two 30-gal. hot water heaters. Distribution is through two 3/4-inch polyethylene pipes. Water flow is controlled by thermostatically controlled zone valves.

Ventilation is completely non-mechanical and manually controlled. Continuous 2-ft. high openable panels along the north wall are opened during warm weather to allow airflow across the two rows of pens. A continuous 2 in. slot along the top of the south wall serves as an air outlet. Air entrance is through cable controlled vertically sliding ventilation panels the full length of the south wall. An external, bottom-opening, manually controlled curtain is used to provide partial shade for the south row of pens during the summer and to reduce infiltration on cold windy nights. Drip coolers are used for increased sow comfort during hot weather.

Electrical energy use data are not available. A recording kWh meter was installed during Summer 1985. Data will be collected until Spring 1986. A propane meter was not installed until January 1985. Propane useage from January through September 6, 1985 was 566.6 gallons. At 65¢ per gallon that represents a cost of $368 for nine months operation. An estimated 20 - 25% of that cost is believed due to manual operation of the in-floor auxiliary warm water heating system because of malfunctioning zone valves. Construction costs for the complete system was $1111 per sow space.

Pig performance data have not been fully evaluated. However, several pieces of data will help to illustrate results to date: pigs weaned per sow -- 9.5 average; pigs weaned per gilt -- 8.5 average: and pig weight at 21 days -- 12 to 15 lbs. A number of litters have averaged 15 lbs. at 16 days of age.

To date, no significant problems have been encountered with either installation. A determined need for creep boxes is the only problem with unit No. 1. During the summer of 1985 several sows in unit No. 2 acquired a habit of playing with the pig nipple waterers. These were a non-shielded design and were positioned at the front of the sow pen, below the sow waterer. Some of the sprayed water entered the creep box and led to pigs dunging in the creeps. This problem was remedied by replacing the nipples with a shielded design which allows the sow to drink, if she chooses, but prevents playing and random spray patterns. Initially, performance of the solar system was being reduced due to air leaks in the collector-to-PVC pipe transitions at each end of the collectors. This problem was corrected by adding insulation to access panels and additional caulking.

<u>Summary</u>

Experience over the past year has shown the monoslope MOF to be a viable cost-effective alternative for use as a farrowing house. As with any system design, differences in management ability and producer preferences mean systems of this design are not for everyone. Reductions in expenditures for external energy inputs for space heating and/or operation of ventilation equipment and modest construction cost savings are among the benefits to be derived. Animal performance has been equal to or better than performance in many conventional farrowing houses. If you're thinking of building, don't overlook the potential benefits of solar heat and non-mechanical ventilation. They might be your way to more profitable pig production.