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## Exhaust air from a farrowing house used to heat a greenhouse (1977)

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Summary

Exhaust air from the Kansas State University swine farrowing house provides most of the heat needed in a greenhouse adjacent to it. The air apparently is not toxic to any of the vegetable plants tested. Tomato plants in the exhaust-air-heated greenhouse have grown faster and bigger, come into yield sooner, and produced several times more tomatoes than have plants grown in the control greenhouse heated by propane.

Introduction

Warm air is removed from the swine farrowing house continuously to remove moisture from the building. Air temperature in the building is maintained at 82°F. (28°C.). Thus, the exhaust air also removes much heat, which is wasted in the usual situation.

In view of increased energy costs and intensified efforts to conserve energy, we considered possible ways to use or recycle some of that wasted heat. Learning that commercial greenhouses are especially hard hit by increased heating costs, we decided to investigate the possibility of heating a small greenhouse with exhaust air from the farrowing house.

Procedure and Results

A greenhouse 10 feet by 20 feet (3.41 x 6.82 meters) was constructed on the south side of the farrowing house and exhaust air was vented directly into it. (A small supplemental heater is available if needed.)

The first trial was to determine if the exhaust air contained any toxic substances. Several kinds of lettuce, tomatoes, eggplant, and pepper were planted in the beds. No toxic effects were demonstrated, and it appeared that the exhaust air had a beneficial effect. Plants in that greenhouse grew faster and were larger and darker than those in the control glass greenhouse (elsewhere on the campus).

Tomatoes were chosen as the vegetable crop to be used in further trials. An excellent crop of tomatoes was produced in the second trial; again, those plants in the greenhouse heated by exhaust air grew faster and yielded more tomatoes than did plants grown on campus in the control greenhouse.

We then built a second greenhouse on the south side of a building near the farrowing house

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so that we might have a more nearly precise control. Heated with propane fuel, it is similar in size and design to the greenhouse heated with the exhaust air. Soil in the beds of both greenhouses came from the same source. Tomatoes were planted in the greenhouses at the same time. As before, the tomatoes in the greenhouse heated by air exhausted from the farrowing house grew faster and bigger, began to fruit sooner, and yielded several times more fruit than did those in the nearby control greenhouse.

### Discussion

Results of this study are preliminary, and we still must work out some of the specific cultural factors involved in growing high-quality tomatoes in the exhaust-air-heated greenhouse. In every trial to date growing tomatoes and other vegetables in the greenhouse heated by exhaust air has increased their growth and yield.

Increased yield may be due to the fact that the exhaust air contains several times as much carbon dioxide as the normal atmosphere. Some commercial operators do add carbon dioxide to the air in their greenhouses during certain periods of time to increase productivity.

We are continuing research in our unit. The current trial includes growing tomatoes and European forcing cucumbers (a variety that does not require the presence of bees for pollination). Both tomatoes and cucumbers were planted in late September. We hope to involve researchers in Foods and Nutrition in a study of flavor and nutrient content of the crops now being grown.

This greenhouse project offers the swine producer at least three possibilities: (1) producing vegetables for home consumption out of season; (2) growing tomatoes and cucumbers (or possibly other vegetables) for sale or; (3) growing many different types of flowering plants or bedding plants for home use or for sale. With both heat and carbon dioxide available at minimum cost, such operations should be practical. The size of a greenhouse that can be heated depends upon the size of the farrowing house and the amount of air exhausted.