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Using exhaust air from a swine finishing house to grow vegetables and plants (1980)

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Using Exhaust Air From a Swine Finishing House to Grow Vegetables and Plants

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Summary

Exhaust air from a Kansas State University swine finishing house provides CO_2 and possible other gases that are used by vegetable plants. In addition, a rock storage system reduces fuel requirements of the greenouse. Tomatoes, cucumbers, and broccoli transplants have been grown in the greenhouses.

Introduction

The project objectives are: 1. To evaluate the production, quality, and acceptance of greenhouse crops grown in hog house air. 2. To determine if exhaust air from a hog house can be economically used to improve use of solar energy in a greenhouse by recirculating air between the greenhouse and the hog house. 3. Compare the fossil fuel needed to maintain greenhouse supplied temperatures in a conventional green house with that needed in a greenhouse supplied with exhaust air from a swine building. 4. To estimate the reduction in fuel per unit of cucumbers, tomatoes, or secondary crops produced in a greenhouse-hog house unit equipped with solar energy storage to that used in a conventional greenhouse.

Procedures

Two greenhouses both 6m x 7.3m (20 x 24 feet), double layered, inflated polyethylene were used in 1979-80 to grow Sandra cucumbers in the fall and Tuckcross 520 tomatoes in the spring. And two crops of Green Comet broccoli transplants were grown in the spring of 1980. One greenhouse attached to a swine finishing unit got exhaust air from the swine building. Excess solar energy collected in the greenhouse was stored in a rock storage system containing about 1 cubic meter of rock for each 6 square meters of greenhouse floor space. The control greenhouse was attached to a headquarters building and had neither energy storage nor air from the swine finishing building. Instead of using soil for a growth medium as we did earlier, we used a synthetic soil medium and fertilized the plants at various rates of application.

Results and Discussion

The cucumber, tomato, and broccoli transplants grown in the experimental house all had darker leaves than those when grown in the control house.

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The experimental house produced 31 percent more marketable cucumbers by number and 40 percent more by weight than the control house.

Tomato yields in the spring reversed that trend because blossom end-rot was worse in the experimental house than in the control. More deformed tomatoes in the experimental than in the control greenhouse may have resulted from excess nitrogen in the experimental house.

Broccoli transplants were grown in the same medium in both greenhouses. Even though the temperature, fertility level and watering was similar, plant growth was much superior in the experimental house. This was probably from increased CO_2 available. Chemical analysis showed broccoli plants in the experimental house contained much more nitrogen than those in the control house. Either the increased CO_2 or some other material supplied by the air exhausted from the swine finishing house influenced transplant growth both in quantity (dry weight) and quality (nitrogen content) of the plants.

Present Work

Sandra cucumbers will be grown in the fall of 1980. Poinsettias will be grown on the south side of the greenhouse where lack of space precludes trained cucumber plants. Fertilizer studies will be used in greenhouses. In the spring, greenhouse tomatoes will be grown as the major crop with bedding or vegetable transplants as secondary crops. A higher percentage of soil will be used in the medium mixture than was used in the 1979-80 studies. Partial funding for this project is provided by the Science and Education Administration of the U.S. Department of Agriculture.