NOTE ON THE THIRD INTERNATIONAL GREENHOUSE ENERGY SYMPOSIUM

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The Third International Greenhouse Energy Symposium was held at the Ohio State University in Columbus August 21 to 26, 1983. Several papers are reviewed here.

Energy saving systems

Thermal screens in Germany were reported to save 20 to 40% of the total fuel consumption in greenhouses at 64F air temperature. A good screen should close tight, limit light transmission losses, and should be planned in the design of future construction. The material used should provide high insulation, have low cost and be guaranteed for a given period.

Soil heating for bulb cut flowers (iris and gladioli) with warm water (95F) was reported to save 33% of fuel costs in France and increase rose production by at least 10% in Canada when used in raised soil benches. Infrared heating trials in the Netherlands showed a 22% gain in energy compared to a hot water pipe heating system at ground level. However, the radiation distribution was poor, with temperature differences of 4 to 5F horizontally and 13 to 14F in the plant canopy. The pipe system at ground level provided a 10 to 20% saving compared to an overhead system.

Reducing infiltration in glass greenhouses, and insulating the concrete foundations, saved 20% of fuel bills in commercial greenhouse operations in Alberta, Canada. Because concrete walls radiate as much energy as a single layer of glass, as shown on infrared photography, it is very important to insulate.

Alternative glazing materials

1. Double poly

In Ireland, research showed double air inflated polyethylene saved 30 to 35% energy over a 3 year period, while transmitting 62% of PAR (photosynthetically active radiation). Savings are reported to be lower (20%) in Alberta, but similar to those found in Ohio research greenhouses.

2. Rigid panels

Results from Canada indicated that PVC rigid panels saved 70% of the fuel while transmitting 80% of the radiation of a single layer of glass (50% for PVC and 61% of the outside radiation).

Exolite and other acrylic panels are reported to save 60% energy and transmit 8% less light than a single layer of glass in Ohio, and only 40% savings in the Netherlands. Generally, under any type of double cover, a significant in-

Table 1. Information on energy saving materials.

Material	Energy savings	Radiation transmission	Durability
Double poly	30-40	60-65	3 years
Double poly over glass	60	45	2-3 years
Exolite	60	50	10 years ?
PVC rigid panels	70	50	?
Acrylic panels	40	?	10 years
PVC panel under glass	40	60	?
Thermal Blankets	20-40	—	3-4 years
Qualex	45	50	?

Editor's Note: Energy saving percentages seldom provide a base. For example, is a 60% saving 60% of what would be the cost, or amount of fuel, for the entire year or the coldest night? In a conventional, glass covered greenhouse? Is this a total? Keep in mind that about 75% of the energy loss from a greenhouse is through the roof and about 70% of the energy is used at night, so, $.60 \times .75 \times .70 = .32$ or 32%. Is this the correct figure? Obviously, no savings are available in the summer in terms of fuel consumption for heating. There is an awful lot of misinformation wandering around out there.

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crease of the relative humidity was noticed compared to a single layer (10 to 15% usually). This may be a problem for the vegetable grower, but should not affect production of ornamentals.

The plant response under the different materials, including double glass, showed that the reduced light and the increase in humidity generally delayed production and reduced the total yield of vegetables (cucumber and tomato) and significantly reduced the production of roses. The main effect on the production of flowering pot plants under double glass is a tendency to elongate, especially for poinsettias and pot chrysanthemums. This can be easily controlled by a slight modification of cultural practices (another application of growth retardant). However, all the experiments described did take place in areas with low winter light (Ontario, Ohio, the Netherlands) and, therefore, are very different from Colorado winter conditions. Furthermore, data on light transmission are very confusing and vary depending upon location of the sensor and its type.

Cultural Information

1. Movable benches

Growers in the Netherlands are trying movable benches for rose production. They can achieve 91% production area instead of 65%, but, this requires high investment and special practices (own-rooted cuttings grown in rockwool in containers and using trickle irrigation). Claims are that this method increases total production by 40% without changing quality. Plants are still producing well after 5 years.

2. Optimum temperature on cut Gerbera

Gerbera temperature should be controlled at the soil level, where the rhizome is located, because the development of a flowering shoot depends on the temperature of the rhizome. Usually a plant produces 20 to 40 flowers per year and is kept 18 months in the bench. Optimal temperature depends on the clone, but usually 55F night, 63F day, is satisfactory. However, a higher temperature regime (70F night and 77F day) is recommended during the summer when light intensity is high.

Selection and breeding of new cultivars improve productivity dramatically by reducing the number of leaves developing before flower initiation. The present cultivars require 6 to 8 leaves before initiating flowers, whereas the new clones only require 4, thus reducing labor costs for removing the surplus leaves, and reducing overhead by reducing the time for flowring. Gerbera are also a nice energy saving plant in the sense that the temperature (the heat) is required at the soil level and then can be as much as 10F lower at 5 feet as compared to plant level without affecting production.

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