

Flammability Control of FRP Greenhouse Coverings — Progress Report I

K. L. Goldsberry

During the past 2 years over 100,000 square feet of Fiberglass Reinforced Plastic (FRP) covered greenhouses have been destroyed by fire in the State of Colorado. Each fire was initiated differently and burned at a rate of approximately 10,000 square feet per minute. Fires have occurred at night without wind and/or during the day with winds present and fans operating.

For the past 8 months, tests have been conducted to evaluate methods of reducing the fire potential and burning rate of greenhouses covered with fiberglass reinforced plastic. The study, a joint program by the University and Florist Mutual Insurance Company, has been conducted in three phases. A standard pipe frame greenhouse 20 ft. x 60 ft. was constructed. Greenhouse grade FRP, PVC, and polyethylene film were used to cover the structure during the various phases of the study.

Phase I

The structure was partially covered with FRP and PVC. The PVC was used as physical barriers in anticipation that it would melt and drop out, thus preventing the spread of fire. A 12 mph artificial wind was used and the fire started in the aspen cooling pads (Fig. 1). The pads immediately burned and the fire spread to the roof and jumped all PVC barriers (6", 12", and 24").



Figure 1. Controlled fire started in cooling pad area and jumping PVC barriers of 6", 12", and 24" in a 12 mph artificial wind.

Phase II

FRP with PVC barrier panels (24" and 48") was installed on 1/2 the structure and polyethylene film was used to cover the remaining portion. A 25 mph artificial west wind was produced, and an air movement of approximately 1/2 mph was developed in the greenhouse with an exhaust fan.

The fire was started in the aspen pad area but failed to spread rapidly because the natural winds changed from light and variable to approximately 10 mph and varied from north to east. The fire did jump the barriers.

Phase III

Two fire retardant panel barriers were installed in the west half of the house. In one section of the side wall, the top half was also fire retardant materials. An outside sprinkler system was installed over the east half of standard FRP panels. An exhaust fan produced air movement of approximately 2 mph through the structure. An artificial wind of 25 mph was periodically used creating a gust effect. The fire was started on the ground at the pad end and within 3 minutes the building was totally consumed by fire.

Summary and Discussion

1. Heat (approximately 800°F or match temperature) is required to volatilize components of the plastic resins in FRP panels. The more vapor present the greater the flammability. Once the volatilized gas is ignited more heat is created, and with air movement, the fire spreads rapidly or even "explodes."

2. FRP can be ignited by grass fires (demonstrated in Phase I).

3. Aspen excelsior or paper type pads create enough heat for ignition.

4. Every fire has different contributing atmospheric conditions. In some instances a barrier or sprinkler system may function; in other cases, they will fail completely.

5. Research will continue until a positive method of detecting and controlling fires in FRP covered greenhouses is achieved. Industry is working to develop a panel that will retard fire, be weatherable, and still transmit enough light for proper plant growth.

FRP greenhouse fires may be controlled by utilizing a sensing element to detect the earliest by-products of combustion, sound an alarm, turn off all exhaust fans and/or electricity, energize a sprinkling system, and perhaps put water in the cooling pads.

6. Safety is still one of the best preventions of greenhouse fires.

Do - use good safe electrical systems

Do - keep weeds down around the outside

Do - keep a clean boiler room

Do - keep fertilizers, chemicals, etc. stored outside the boiler room and preferably in a separate building.

Do - be careful when welding - sparks ignite pads, refuse, etc.

Do - not allow fireworks around the greenhouse - especially sparklers.