Colorado Flower Growers Association Inc.

IN COOPERATION WITH COLORADO STATE UNIVERSITY
Dorothy Conroy, Executive Secretary
Bulletin 202 | 901 Sherman St., Denver, Colorado 80203 | February 1967

LIGHT TRANSMISSION OF REFINISHED FIBERGLASS

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During the past six years the majority of new Colorado greenhouses have been covered with some type of corrugated fiberglass. The earliest materials contained a fiberglass mat embedded in polyester resin. After two or three years of weathering it was apparent the material would have to be recoated to prevent "fraying" or "blooming" of the fibers. If "fraying" progressed dust accumulated in the remaining impressions and light intensity was reduced. These fiberglass coverings also developed a yellowish color. This color change was apparently due to the accumulation of dust and perhaps to some degree a reaction caused by heat or some phase of the light spectrum.

The advent of acrylic modified materials has increased the longevity of most fiberglass coverings. The presence of at least 15 percent acrylic resin has retarded weathering and provided a material that will generally not need recoating for 5-8 years. Some fiberglass manufacturers are applying additional coatings of various types to the surface to provide increased longevity.

Methods and Materials

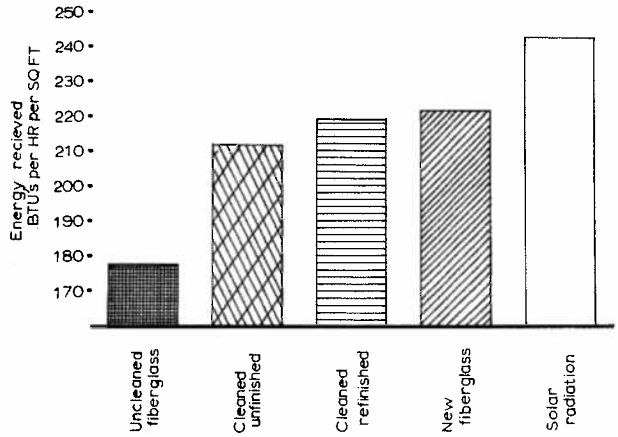
On March 15, 1960, polyester type fiberglass was installed on a greenhouse. Five years and six months later one panel was removed for evaluation. The glass fibers were loose and were 1/2 inch to 3/4 inch long. Dirt was imbedded in the impressions, and the panel appeared very dirty. One third of the panel was not cleaned in any way. Two thirds of the panel was cleaned with a trisodium phosphate solution and scrub brush. All of the remaining loose fibers were removed with coarse steel wool and the panel thoroughly washed with water. After drying, one half of the cleaned panel was recoated with an acrylated refinisher applied by brush.

The percentage of heat and spectral transmission received by the sensing elements under the various panel treatments was compared to natural solar radiation and the amount transmitted through new acrylated material. All data were taken when the sun was at maximum altitude for any day of measurement. Total and diffuse radiation transmitted through the materials was measured with a Sol-A-Meter Mark II pyranometer made by the Yellott Solar Energy Laboratory, Phoenix, Arizona. Measurements were made in Fort Collins, Colorado. The spectral transmission qualities of the treatment panels was measured with a Model SR and SRR Spectroradiometer made by ISCO of Lincoln, Nebraska. These measurements were made in Ames, Iowa.

Results

Figure 1 shows the total amount of radiation (BTU's/hr/ft^2) transmitted through the three panel treatments as compared to the transmission through new acrylated fiberglass and received from unobscured solar radiation. The total heat transfer of the uncleaned section of the panel was 26.8 percent less than the unobstructed solar radiation and 20 percent less than the transmission through new acrylated fiberglass.

Fig. 1. Mean solar radiation received from unobstructed sun and through four fiberglass samples during three one hour periods when the sun was at maximum altitude. Aug. 12, 13, and 15, 1965, Fort Collins, Colorado.

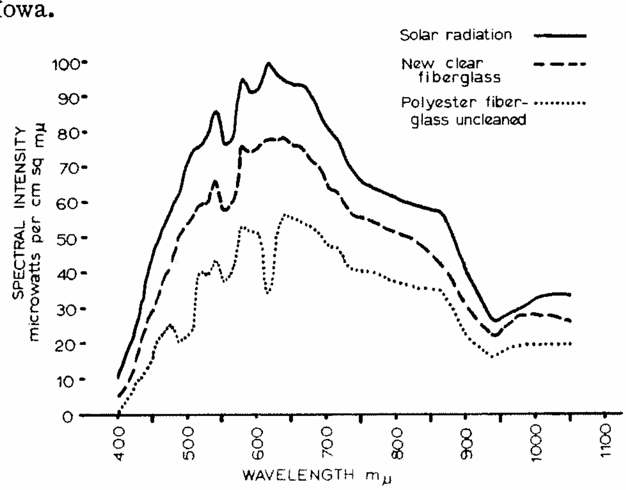


Washing and cleaning with the solution and steel wool increased transmission 14.1 percent over the uncleaned section. Application of refinisher increased transmission another 2.7 percent. The refinished section of panel transmitted 98.5 percent as many BTU's/hr/ft2 as new acrylated fiberglass.

Spectral Transmission

The relationship of spectral intensity and distribution obtained from unobstructed solar radiation, through new acrylated fiberglass, and through weathered (66 months) polyester fiberglass is shown in Figure 2. There was a decrease in over-all spectral transmission from uncleaned polyester fiberglass with definite effects appearing in the 500 mu (millimicrons) and 600 mu areas. The greatest decrease

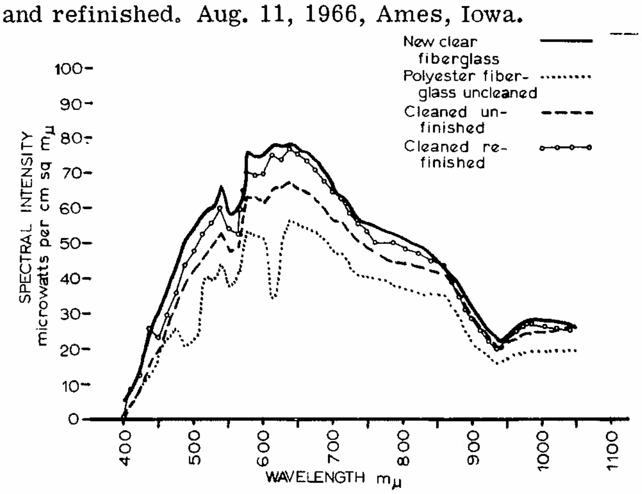
Fig. 2. Spectral distribution and intensity of weathered polyester fiberglass (66 months), new acrylated fiberglass and solar radiation. Aug. 11, 1966, Ames, Iowa.



in intensity occurred in the area between 500 and 750 mu.

When uncleaned polyester fiberglass was washed the spectral transmission increased evenly throughout the area between 450 and 850 mu and the decreased intensities around 500 and 600 mu almost disappeared (Fig. 3). The application of refinisher increased transmission in the range from 650 to 1050 mu to that of new acrylated fiberglass. The transmission from 450 to 650 mu was not increased as effectively. Most of the yellowish color produced in the dirty fiberglass disappeared when the material was washed and refinished.

Fig. 3. Spectral distribution and intensity of weathered polyester fiberglass (66 months) when cleaned and refinished. Aug. 11, 1966, Ames, Iowa.



Discussion

It is evident from these preliminary studies that weathered fiberglass panels can be effectively refinished to provide spectral transmission almost equal to that of new acrylated fiberglass. The slight yellow hue developed in the weathered fiberglass does not greatly affect light transmission when panels are recoated and probably has little or no effect on plant growth.

Several factors should be considered before refinishing:

1. Don't wait until the fibers have completely frayed. Application of a refinisher before an excess of fibers are removed will be advantageous.
2. Use an effective known cleaning compound and rinse well. It would be wise to ''spot'' test any unknown cleaner before it is used.
3. After rinsing thoroughly make sure the material is dry before applying the refinisher.
4. Apply approved refinishers with an acrylic base. Application should be done on a windless day so that a minimum of dust will be involved. The better refinishers will dry in approximately 15 to 30 minutes.
5. Due to the rapid drying of some refinishers, it

appears that brush application is superior to spray methods.

Research and evaluation of plastic coverings, their durability, transmissivity and refinishing methods will continue at Colorado State University in hopes of obtaining the most desirable covering for plant growth.

CONTROL OF RHIZOCTONIA STEM ROT IN COLORADO

Ralph Baker

Rhizoctonia stem rot is not usually associated with carnations in Colorado. Occasionally cuttings shipped into the state have been infected, however, and significant losses occur. In many of these instances symptoms develop within a few weeks after transplanting and the grower wishes to know whether control measures can be applied with satisfactory results. There is no simple answer to this question. A single Terraclor drench is usually sufficient for control (4), however, carnations are known to become resistant as they mature (3). Thus, is it worthwhile to go to the expense and trouble of an application of Terraclor if the plants are already resistant? Has the fungus already spread so far in the bench that penetration of numerous plants has already occurred, thus nullifying the protective action of Terraclor? The experiment described below was set up primarily to answer these questions.

In addition the value of aerated steam (1,2) in control was assayed. Also, because Terraclor is fairly immobile in soils, a drench does not insure even distribution of the fungitoxin at all depths. Thus in one treatment the chemical was thoroughly mixed into the soil.

Treatments were applied to bench plots measuring 40'' x 48'' x 6''. These were separated to prevent cross contamination of the soils. Plots were steamed at 180° F for at least one half hour. After cooling, approximately 1500 cc of aerated steamed soil (160 °F for one half hour) was mixed in certain plots. The soil was incubated at greenhouse temperatures for three days to allow residual organisms in the aerated steamed soil to establish in these plots. All plots were then planted with rooted carnations at a 3'' x 4'' spacing. A sand cornmeal mixture containing Rhizoctonia solani was placed against the plant in the corner of each plot. A Terraclor drench was immediately applied to certain plots at the rate of 1 lb. of 75% active in 100 gallons of water, one quart per square ft. After symptoms had appeared in the inoculated plants in the controls (14 days after transplanting), a Terraclor drench was applied to other previously nontreated plots. At this time one half of the plants were cultured from each plot to determine the incidence of Rhizoctonia, leaving the 30 remaining plants in a 6'' x 8'' spacing. These were grown and flowered in conventional culture. Rooted cuttings were transplanted December 24, 1965, and final readings on disease incidence were taken June 15, 1966.

Table 1. Number of plants dead approximately six months after inoculation in plots treated in various ways for control of Rhizoctonia stem rot of carnations.[a]

Treatment	Replications I	II	III	Average
Aerated steamed	4	13	0	6
Terraclor mix	0	1	1	1
Terraclor drench	0	0	0	0
Terraclor drench delayed 14 days	1	1	1	1
Inoculated control	15	6	11	9
Noninoculated control	0	0	0	0

[a]Each replication per treatment contained 30 plants.

Data on disease incidence in the three replications are given in Table 1. A Terraclor drench applied when inoculation occurred insured complete control of Rhizoctonia stem rot--even plants in contact with the inoculum did not die in treated plots. Applications 14 days after inoculation were also effective. No increase in control resulted from mixing Terraclor in the soil.

The data are given in detail listing replications to show the variation in control in the aerated steamed plots. The procedure for aerated steaming of soil is conventionally applied to the whole soil volume to be used ultimately. It was not practical to do this in this experiment since adequate equipment was not available. Thus, the results recorded here should be interpreted with this in mind. They would indicate, however, that the use of aerated steam was not as efficient in control as application of Terraclor and that there was considerable variability.

The ''pattern of spread'' was as might be expected. The inoculated plant developed symptoms first, followed by adjacent plants. Typical data recorded at intervals during the experiment are given in Table 2 for the inoculated controls.

The fungus was not recovered very frequently on the 14th day after transplanting; even from plants 3-4'' from inoculated plants. Indeed there were only two plants (in inoculated control plots) from which the fungus was recovered. This indicates that spread and penetration of the hosts by the pathogen had not

Table 2. Number of plants dead over successive intervals in the inoculated control plots. One plant in the corner of each plot was inoculated. Spacing was approximately 6'' x 8''.

Date losses were recorded	Replications I	II	III
February 15, 1966	2	1	1
February 25, 1966	3	2	3
March 25, 1966	7	3	5
June 15, 1966	15	6	11

been accomplished to any great extent during this period.

Thus we can conclude that application of Terraclor even after symptoms are apparent (at least if they develop before 14 days after transplanting) will check the spread of Rhizoctonia from infected plants and is financially warranted. The experiment described above does not tell us how long after transplanting Terraclor can be applied with favorable results. This will have to await further experimentation.

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