LF-10 a Good Disinfectant*

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If you're one of those who is content to be average, don't read this article; on the other hand, if you fancy yourself as an opportunist, well, the opportunity to take a giant step in better disease control is here. Plant disease control or we might say "programmed" disease control has many integral parts, all of which are important in the overall result. You know how difficult it is to control a disease once it has started.

What are the important parts of a disease control program? Basically, we can group them under post- and pre-

FIGURE 1. Use the disinfectant LF-10 to wash hands before working with the plants.

*The authors wish to thank Mr. Robert Oglevee, Oglevee Floral Co., Connellsville, Pa. for his help and enthusiasm in writing this article.

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planting culture. Preparations before planting include the obtaining of clean planting stock and sterilizing pots, potting soil, benches, etc. After planting a crop, disease and insect control through environmental manipulation and programmed pesticide applications is imperative. It is during this post-planting time that one of the oft-times forgotten principles of disease control plays a very commanding role. This principle is sanitation.

Is sanitation really important? Let us consider a situation closely akin to the field of plant pathology, i.e., medical pathology. In this field, sanitary procedures are every day routine to prevent the spread and establishment of disease-causing organisms of man. We are all familiar with the extensive procedures of sanitation carried out before an operation. Surely, in greenhouse culture, plant disease organisms are equally important and deserve proper sanitation procedures to prevent their spread and establishment. Sanitation practices (or lack of them) have often proven to be the weakest link in the disease control program.

What is sanitation? Basically, carefully planned procedures which prevent the introduction of plant disease organisms in a clean area. Sanitation practices need not be of the type carried on in hospitals, such a program is far too rigorous. Although in the production of "disease free" plants such a rigorous program is followed. We would like to think of it as (to quote Professor James Tammen, Pennsylvania State University) 'kitchen sanitation'. The removal of trash and dead and diseased plant parts, hanging up the hose, etc. are the rather obvious parts of a sanitation program. It is the not-too-obvious things such as contaminated tools, feet, hands, etc. that can be the culprit in an otherwise good sanitation program. Everything we use, such as water cans, boards to level your soil, tools to plant, automatic watering systems, pots, potting benches, soil testing tools, etc. may be infested with plant pathogens and may serve as vehicles of plant disease. Plant pathogens also lurk in many corners of the greenhouse, under the benches, on the walks, on the side walls, etc.

Remember these famous words, "What this industry needs is a good disinfectant, and with it, we will go a long way towards eliminating the sanitation problem."

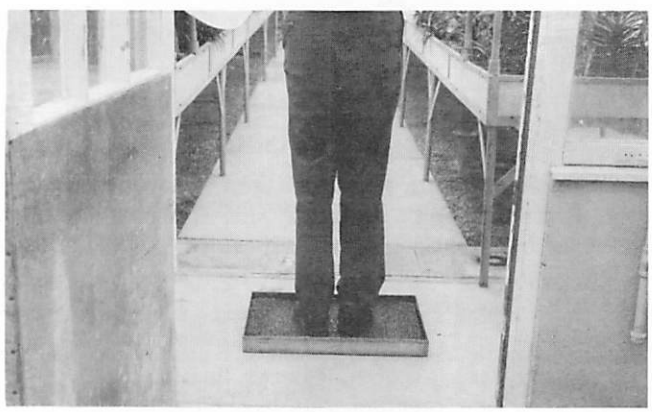

FIGURE 2. Walking thru a foot bath containing LF-10.

What do we mean by a good disinfectant? One that is effective, relatively inexpensive, stable under greenhouse conditions and easy to use. We've used things in the past such as formalin (which is rather noxious and whose vapors are phytotoxic), chlorox (which breaks down readily and is rather caustic), and various fungicidal suspensions (which are difficult to keep in suspension and are effective against fungi only). LF-10, a new disinfectant, does most of the things we want from a disinfectant. LF-10 is 1) non-noxious†, 2) active at low concentrations and, therefore, economically feasible and cheaper than other acceptable disinfectants, 3) easy to use and goes into solution readily, and 4) is stable under normal conditions (for comparison, chlorox's activity is relativity short, generally less than 1 hour when exposed to normal greenhouse conditions.)

Effectiveness of LF-10

LF-10 has been experimentally tested alone and in conjunction with other disinfectants as to the effectiveness against some selected plant pathogenic agents. G. S. Walton of the Conn. Agr. Exp. Station, New Haven, found LF-10 dips 1:50 dilution for 10 minutes and 1:100 dilution for 30 minutes, were effective in eradicating completely *Thielaviopsis basicola, Rhizoctonia solani, Fusarium oxysporum* f. *lycopersici, Verticillium, albo-atrum* and *Pythium* sp. from pieces of sterilized clay pots upon which they had been allowed to grow in a nutritive media for 3-4 weeks. It might be noted that under the same test conditions, only at the high concentration of a 1:5 dilution rate, did Chlorox eradicate most but not all of the aforementioned fungi. Formaldehyde, 1.95% gave complete control in the test. In another study performed by E. S. Wright, (Lehn and Fink Products Corporation, Bloomfield, N. J.) LF-10 was found to be highly active against selected plant pathogens.

Table 1. Number of Colonies Recovered Following Disinfection with LF-10

For 10 min at 20°C*

Dilu of LF-10	Verticillium alboatrum	Fusarium roseum	Thielaviopsis basicola	Rhizoctonia solani	Fusarium oxysporim	Botrytis cinerea	Alternaria tenuis	Erwinia sp. N535-1A	Xanthomonas pelargonii
1:40	0	0	15	0	0	0	16	0	0
1:60	0	0	20	0	0	0	12	0	0
1:80	0	0	12	0	0	0	14	0	0
1:100	0	0	29	0	0	0	14	0	0
1:200	0	0	21	0	0	0	12	0	0
1:400	3	0	34	0	3	0	17	0	0
1:600	1	0	22	0	6	0	30	0	315
1:800	5	0	21	0	80	1	50	0	189
Control (No LF-10)	630000	9900	11000	1500	200000	500	11000	15000000	10000000

*From report by E. S. Wright of the Lehn & Fink Products Corp., Bloomfield, N. J. to Dr. James Tammen.

†Some people are somewhat allergic to this material as it may cause the skin on their hands to peel slightly.

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At dilutions as low as 1:800, a 10 minute exposure was sufficient to kill all individuals of some plant pathogenic species and most individuals of the other pathogens. His results are more clearly demonstrated in Table 1. It will be noted at a 1:200 dilution complete eradication was achieved in all but *Thielaviopsis* and *Alternaria*. Although the eradication was not complete, it is felt a period of exposure longer than 10 minutes might eliminate the few remaining more resistant individuals.

Limitations

LF-10 is not without certain limitations: 1) The active materials of LF-10 are attracted and absorbed to organic matter and thereby become inactive. The material should be used only to disinfect articles or areas which are essentially devoid of soil and organic matter. Any solutions of LF-10 which become dirty because of contamination with soil or other organic matter may be inactive and, therefore, should be replaced with a fresh solution. 2) It should not be used on plant materials. LF-10 has not been cleared, nor is it recommended by the authors, for use on plant materials, although some people have been using it to disinfect certain plant materials and have no plant injury. 3) LF-10 has caused minor skin irritation. 4) Some fungal plant pathogens with thick-walled spores or resistant resting structures, chlamydospores of *Thielaviopsis*, for example, may not be completely eradicated. The mentioned limitations, however, are considered minor for the most part and should not prevent the use of this outstanding disinfectant.

Proper Use

What concentration should be used? If the material is to be used as a dip, how long should the dipping time be? Generally, the 1:200 dilution rate should be sufficient for most purposes. It has been shown that a 1:200 dilution used as a dip for 10 minutes is sufficient to eradicate most plant pathogens. A more cautious individual might increase the dipping time, the concentration, or both. At the 1:200 concentration, a dipping time of 30 minutes would decrease any margin of error. If pots are to be disinfected with LF-10 (for clay pots the best method of sterilization is by steaming, whenever possible), the dipping time should be at least one hour in a 1:100 concentration. Remember, the cleaner the object to be disinfected, the more thorough the eradication, for soil and organic matter may absorb LF-10 and render it inactive.

Table 2. Dilution Rates for LF-10

DILUTION	LF-10	WATER
1:200	4 tsp	1 gal
	8 tsp	2 gal
	3 oz	5 gal
1:100	8 tsp	1 gal
	5 tbsp	2 gal
	6 oz	5 gal
1:50	5 tbsp	1 gal
	5 oz	2 gal
	12½ oz	5 gal

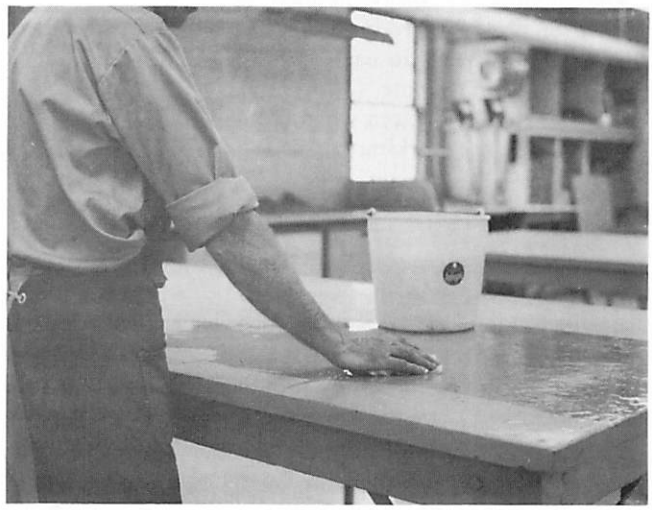

FIGURE 3. Swabbing with LF-10 before placing the plants on the table.

How to Apply

Since LF-10 is stable it can be made up in advance and stored. The material can be effectively applied with sponges, rags, sprinkling cans, etc. One method we have found particularly effective is applying the material through a "hozon" or other proportioner to benches, walkways, under benches, etc. This can effectively be done with any proportioning system as long as you know the dilution rate at the hose nozzle (Table 3). As a dip, LF-10 may be made in large quantities and stored in suitable containers, which may also serve as the dipping containers.

Table 3. Dilution rates for stock solutions to be used with various proportioners.

Type of Proportioner used	Amt. of LF-10 per Gal. of Stock Solution	Dilution Delivered at Hose end
1:10 – 1:16	2½ pts	1:50
(hozon)	1¼ pts	1:100
	9½ oz	1:200
1:100	1 gal	1:100
	2 qts	1:200
1:200	1 gal	1:200

We would like to emphasize this material is not the answer to disease control. LF-10 does, however, fill the need for an effective disinfectant that could improve all greenhouse operations and result in increased grower profits through less plant disease.