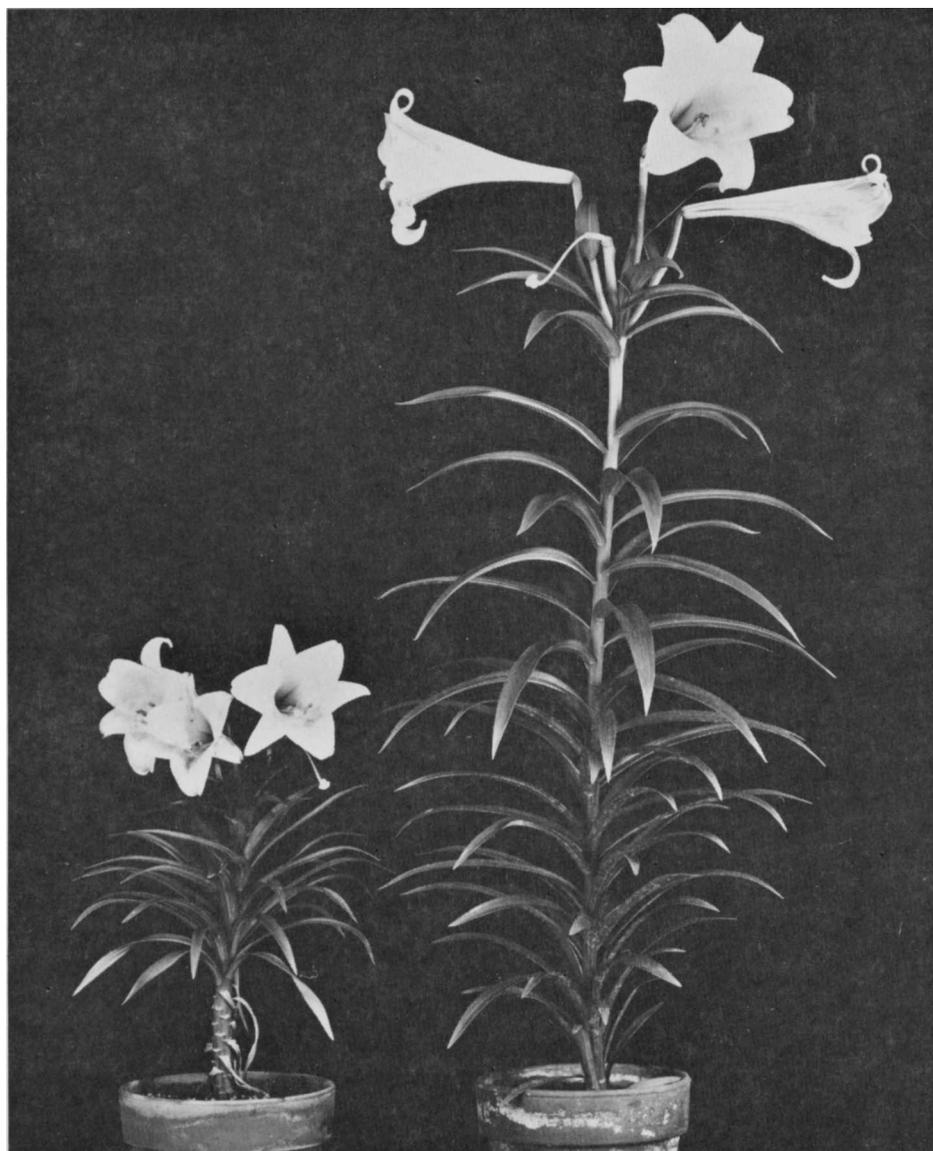


Fungicides

ROBERT D. RAABE

JOSEPH H. HURLIMANN



Easter lily root and bulb disease control. Plant on the left is an untreated check. Plant on the right resulted from a benomyl + Dexon bulb soak and was planted in benomyl + Dexon treated U. C. mix.

Table 1. Results of fungicide treatments in the production of potted Easter lilies, 1967-1968.

Fungicide	Concentration	Equivalent concentration of prepared material	Treatment of:					
			Bulbs only		Soil only		Bulbs and soil	
			Height	Disease	Height	Disease	Height	Disease
			inches	%	inches	%	inches	%
No Treatment—check			17.3*	80*	12.7	47	17.3	80
Chemagro 4497 (50%)	ppm active							
	10	.27 ounces/100 gal.	12.3	57			12.7	75
	50	2.57 ounces/cu. yd.			19.5	49		
PCNB—75%	2700	3#/100 gal.	12.9	52				
Ferbam—76%	3655	4 /100 gal.					14.5	56
PCNB—75%	55	1.9 ounces/cu. yd.						
Ferbam—76%	111	3.8 ounces/cu. yd.			12.4	84		
Benomyl—50%	150	4 ounces/100 gal.	15.1	34			16.5	14
	150	7.78 ounces/cu. yd.			17.4	24		
Benomyl—50%	150	4 ounces/100 gal.	19.2	23			16.6	13
Dexon—70%	100	1.86 ounces/100 gal.						
Benomyl—50%	150	7.78 ounces/cu. yd.			16.1	29		
Dexon—70%	25	.92 ounces/cu. yd.						

* Bulbs in check, soaked in water only for 30 minutes.

ONE OF THE SERIOUS PROBLEMS in the production of pot-grown lilies for the Easter season involves root and bulb rots. Fungi which have been associated with this problem include *Cylindrocarpon radicicola*, *Fusarium oxysporum* f. *lilii*, *Pythium splendens* and *Rhizoctonia solani*. Because of the different fungi involved, fungicide mixtures have been recommended for control, the most common ones mixtures of pentachloronitrobenzene (PCNB) and ferbam or PCNB and Dexon. Disease control was not always good, or consistent, so new materials have been tested as they became available.

The first of the experiments (reported here) was started in the winter of 1967 and concluded in the spring of 1968. Treatments consisted of: (1) bulb treatments only, in which the bulbs were soaked 30 minutes in the desired fungicide or fungicide mixes prior to planting; (2) soil treatments only, in which the soil was treated with the desired fungicides prior to planting; and (3) a combination of both procedures, in which the bulbs and the soil were treated prior to planting. Materials, concentrations and results are given in table 1. Ten plants of the Ace variety were used in each treatment.

The results were: (1) that bulb treatment plus soil treatment gave better control than either treatment alone; (2) that benomyl (effective against many soil fungi such as *Rhizoctonia* and *Fusarium* but not effective against fungi such as *Pythium*) gave as good control when used alone as it did in combination with Dexon (which is effective against *Pythium*)—indicating that in this experiment, *Pythium* was not important in the root rot complex; and (3) that all of the treatments with one exception stunted the plants when compared with the checks. The stunting in the best treatments (benomyl or benomyl and Dexon) was not critical.

The following year, a similar experiment was started. Ten plants of the Ace variety were treated in each of the ways listed in table 2. All plants were grown in 6-inch pots at Sunnyside Nursery in

for control of

EASTER LILY ROOT ROTS

San Leandro. In this experiment, root growth was measured rather than plant heights.

The results of this experiment were: (1) that bulb and soil treatments gave better control than either alone (except for the PCNB-Ferbam treatment); (2) that whenever Dexon or Terrazole (both effective against *Pythium* and closely related fungi) were used, excellent control resulted—indicating that in this lot of bulbs, *Pythium* was the important disease-producing organism and the other fungi in the complex which are controlled by benomyl or Mertect were of little importance; (3) that soil treatments alone resulted in nearly as good root systems as the soil and bulb treatments but that the latter gave better disease control; and (4) that with the increase in disease control, there was a corresponding increase in root production. The latter is important in that plants, when moved into homes generally do not receive as good care as those in greenhouses. Plants having better root systems will keep longer than those having poor root systems.

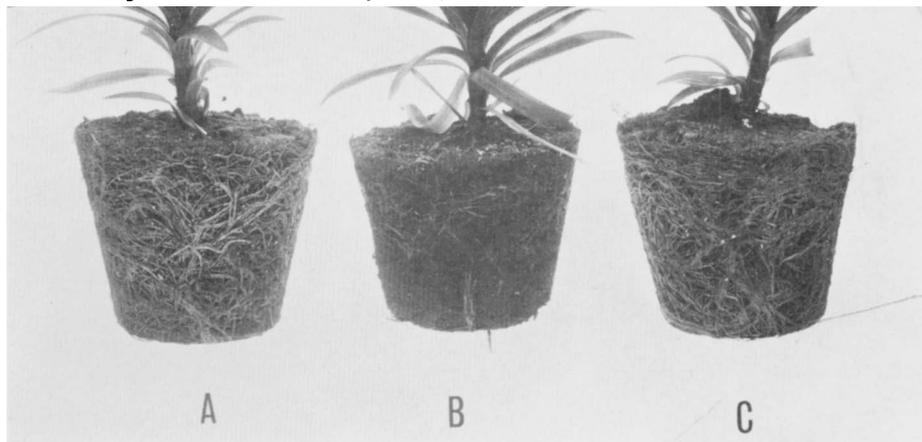
Inasmuch as Easter lilies are vegetatively propagated, the bulbs frequently are carrying root and bulb-rotting fungi when brought into nurseries for forcing. From the results of the experiments reported here, it can be seen that the main cause of root rot in lilies may vary from one year to another. In other experiments, it has been found that the organisms may vary depending upon the source of bulbs. For this reason, lily bulb treatments should consist of a mixture of Dexon or Terrazole and benomyl or Mertect. Control also will be better if bulbs and soil are treated prior to planting. Experiments are in progress to determine if the fungicides can be added to the soil as drenches during the growing season, rather than mixed in the soil prior to planting.

Of the materials recommended, only Dexon, Benlate (benomyl) and Mertect are available at the present.

TABLE 2. RESULTS OF FUNGICIDE TREATMENTS IN THE PRODUCTION OF POTTED EASTER LILLIES, 1968-1969.

Fungicide	Concentration	Equivalent concentration of formulation	Bulbs only		Treatment of: Soil only		Bulb and soil	
			Root* production	Disease %	Root production	Disease %	Root production	Disease %
No Treatment—Check			5.1	65.6	5.2	50.0	5.1	65.5
PCNB 75% WP	2700	3 lb/100 gal.	6.2	27.0	5.8	31.0	6.1	41.5
Ferbam 76% WP	3655	4 lb/100 gal.						
PCNB 75% WP	52	1.76 ounces/cu. yd.						
Ferbam 76% WP	104	3.5 ounces/cu. yd.						
Benomyl 50% WP	150	4 ounces/100 gal.	7.8	84.0			4.2	65.6
	10% (Granular)	2.43 pounds/cu. yd.			3.7	67.5		
Mertect 60% WP	50	1.1 ounces/100 gal.	5.6	58.0			6.8	30.0
	60% WP	2.17 ounces/cu. yd.			4.6	50.5		
Dexon 75% WP	100	1.86 ounces/100 gal.	6.5	35.5	9.0	11.0	9.7	Trace
Benomyl 50% WP	150	4 ounces/100 gal.						
Dexon 5% (Granular)	25	12.85 ounces/cu. yd.						
Benomyl 10% (Granular)	150	2.43 pounds/cu. yd.						
Dexon 70% WP	100	1.86 ounces/100 gal.	6.2	36.7	8.1	18.0	9.0	Trace
Mertect 60% WP	50	1.1 ounces/100 gal.						
Dexon 5% (Granular)	25	12.85 ounces/cu. yd.						
Mertect 60% WP	50	2.17 ounces/cu. yd.						
Terrazole 35% WP	50	1.9 ounces/100 gal.	5.7	54.5			9.3	Trace
	35% WP	3.67 ounces/cu. yd.			9.0	10.0		
Terrazole 35% WP	50	1.9 ounces/100 gal.	4.7	64.0	9.3	8.50	9.5	5.5
Benomyl 50% WP	150	4 ounces/100 gal.						
Terrazole 35% WP	50	3.67 ounces/cu. yd.						
Benomyl 10% (Granular)	150	2.43 pounds/cu. yd.						

* Root rating based on number of roots produced, 0 = no roots, 10 = root ball completely filled with roots.



Lily root and bulb rot control in soil treated with benomyl and Dexon. A. Plant resulting from bulb being planted in soil treated with benomyl and Dexon. B. Untreated check. C. Plant resulting from pre-plant bulb soak in benomyl + Dexon and grown in soil treated with benomyl and Dexon.

R. D. Raabe is Professor, and J. Hurlmann is Laboratory Technician, Department of Plant Pathology, University of California, Berkeley.