Fungicidal dips for Easter lily bulbs

A recent experiment involved dipping Easter lily bulbs in fungicides after the lilies were brought into the packing house from the field, but before they were packed for shipping. The experiment demonstrated the usefulness of dipping bulbs in Benlate before packing, and substantiated a number of earlier experiments with chemicals for forcing Easter lilies and for controlling disease.

...treatment before shipment

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Truban, Benlate and a similar material, Topsin M, were tested as fungicidal dips for Easter lily bulbs. They were used singly and in the following combinations: (1) no treatment (check); (2) Truban; (3) Benlate; (4) Benlate plus Truban; (5) Topsin M; (6) Topsin M plus Truban. Rates of application were: Benlate 50W, 4 oz per 100 gal water; Topsin M 50W, 4 oz; Truban 30%, 4 oz. The same rates were used for the combination treatments. Period of dipping was 5 minutes. The bulbs were Ace yearlings, unsorted and somewhat variable in size. After dipping they were partially dried and packed in moistened peat in standard shipping boxes.

Dipping and packing were done on October 18, 1972. The boxes were labelled and left in the unheated packing shed until November 20, 1972. They were then opened and the bulbs examined. Since there were no obvious differences between treatments, random samples of bulbs from all treatments were put in plastic bags, taken to the University of California, Riverside, and stored in the bags at 50°F. Such storage conditions were calculated to favor disease development, but they also favored premature sprouting, a shorter growing period and reduced bud count. Thus the dipping treatments were severely tested by unfavorable storage conditions. Greenhouse conditions during forcing were uniformly good.

On January 8, 1973, the bulbs were examined, weighed, planted deeply in 6-inch pots, and arranged on the greenhouse bench in randomized blocks.

Forcing dipped bulbs

In the central trial, five blocks of 18 Easter lilies each, variety Ace, were divided among six treatments. A number of plants equivalent to two blocks, includ-
ing all treatments, were used as buffers against edge effects and for occasional sampling. Table 1 shows bud counts for 15 plants in each treatment. Benlate appeared to be the best treatment. The increase over the check was just significant.

A possible basis for the difference in bud counts was seen when the soil was washed away from the roots and bulbs of three plants of each treatment in one block of the trial. Lesions on roots, bulbs, and stems were rated according to number and severity, and the combined ratings for each plant were averaged (see table 2). Additional ratings from plants outside the main trial gave comparable results. Benlate was outstanding in giving the healthiest root system (see photos 1, 2, 3). Truban combined well with Topsis M, but not with Benlate. These results were statistically significant.

When cultures were made from root and bulb lesions, *F. oxysporum* grew out of the diseased tissue in nearly all instances. In this trial it appeared that Benlate was acting mainly against *Fusarium*. In other trials *Pythium* might be the main pathogen and Truban the effective fungicide. Indeed, *Pythium* may have been present on the roots during this trial, but relatively inactive, because growing temperatures were not too high and soil drainage was good. Plants were left in the pots until the tops died back and new basal roots grew out. Soon after they appeared they rotted, except where the original bulb had been treated with Truban alone. Mixed with Benlate or Topsis, Truban had no effect. In this trial only Benlate alone or Truban alone had a protective effect on the roots. Mixtures were no better than untreated controls.

### Organisms

Earlier trials and experiments indicate that several organisms may be involved in root and bulb diseases of Easter lilies originating in the Pacific Northwest. (This discussion does not take account of nematodes, which are in a separate category, and are unaffected by such materials as Benlate and Truban.) *F. oxysporum*, the species of *Fusarium* attacking lilies, has mild and severe variants. The mild ones by themselves cause little more than yellowing of the outer bulb scales and underground stems. The severe variants can cause root lesions which girdle and kill the large basal roots (see photo 3); they can also cause milder root lesions, and basal, side and tip rot of scales (see photo 2), and stem lesions.

When either the mild or severe variants of *Fusarium* are combined with a second pathogen, a bacterium, *Pseudomonas* sp., they may cause very severe rotting. The symptoms of *Pseudomonas* alone, under greenhouse conditions, may be restricted to scale tip rot and minor lesions on the outer scales. Thus, by reducing *Fusarium* one reduces the impact of *Pseudomonas*, although this may not apply in the field under cold and wet conditions, where severe stem lesions and other damaging symptoms may be due primarily to *Pseudomonas*.

Two other pathogens are *Pythium* al-
Soil conditioning and

SEED POTATO HANDLING are keys
to survival of

SUMMER PLANTED PC

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The relationship between soil physical condition and plant stand vigor was partially revealed in a report of studies 10 years ago. Additional information is now available on seed potato performance and on cultural adaptations that affect plant survival during high temperature planting conditions. The respiratory response of seed potato pieces to conditioning procedures was measured in the laboratory. At the same time the influence of soil conditioning and soil moisture on potato seed piece survival and plant emergence was investigated in the field.

Kennebec potatoes, harvested in late May, were placed into controlled temperature storage of 20°C (68°F) and held there until two weeks before planting. Sufficient time had elapsed for seed to break rest, and sprouting was evident.

One half of a lot of whole potatoes was cut into 43 to 57 g (1½- to 2-oz) pieces two weeks prior to planting and replaced at 20°C (68°F). These pieces were designated as "old" cut seed. The other half was cut into seed pieces 12 hours before planting, and designated as "fresh" cut seed. Seed pieces from each were planted the following day at the U.S.D.A. Cotton Research Station, Shafter. Sufficient amounts of conditioned seed were set aside for use in a respiration study under controlled temperature conditions in the laboratory. Apical and basal seed pieces were kept separated. While potatoes were being cut it was observed that a number of them were infected at the stem end with dry rot. Infected seed pieces were sorted out. However, it became apparent during the laboratory study that not all seed pieces were free of infection.

Respiration

Fresh and old cut seed were each divided into two lots. One lot in burlap bags remained undisturbed in storage at 20°C (68°F) for 12 hours, while the other lot in burlap bags was loaded onto a pick-up truck and transported for 12 hours with air temperature between 20°C and 35°C, while being protected from the sun. After the 12-hour period, seed pieces from 20°C storage and from the truck were redivided again. One lot of seed from each handling treatment was placed at 30°C (86°F) and the other at 35°C (95°F) constant temperature. The evolution of CO₂ from respiring seed was monitored for 144 hours in a continuous ventilated system.

Essentially similar patterns of respiration were obtained at each of the two