SCIENTIFIC APPARATUS AND LABORATORY METHODS

COMPOUNDS FOR CONTROL OF ORANGE DECAYS

DECAYS of fruits, caused either by the stem-end rot organisms, *Phomopsis citri* and *Diplodia natalensis*, or the green and blue mold organisms, *Penicillium digitatum* and *Penicillium italicum*, have resulted in serious economic losses. Investigations on control measures have been carried on intensively over a long period by the U. S. Department of Agriculture Subtropical Fruit Field Station, Orlando, Fla. Recently a brief report[1] was made on the striking effectiveness of thiourea in controlling these diseases. The amounts of thiourea possible of ingestion from treated fruits is much below the lowest dose mentioned in any toxicity studies, but treatment of fruits with this material can not be recommended until prolonged feeding tests have been completed. Consequently, a search has been made for less objectionable compounds of equal effectiveness.

Compounds for testing were selected in part on the basis of structural similarity to thiourea and in part on the basis of reports of promising materials by other workers.[3, 5]

Of twenty-five materials recently tested, thioacetamide, 8-hydroxy=quinoline sulfate and 2-aminothiazole gave good to excellent control of decays. The results obtained with those concentrations found most effective are presented in Table 1.

TABLE 1

CONTROL OF ORANGE DECAYS

Treatment	No. of experiments	No. fruits treated	Decays		
			No. stem-ends	No. penicillium	Per cent. decay
Thioacetamide, 5 per cent. ..	5	232	2	2	1.7
Check	5	231	46	30	32.9
8-Hydroxyquinoline sulfate 5 per cent.	2	86	0	9	10.5
Check	2	86	18	10	32.6
2-Aminothiazole, 5 per cent. (110° F.)	2	80	2	4	7.5
Check	2	83	31	4	42.2

In the experimental treatments oranges were dipped from 2 to 5 seconds in water solutions. Each lot consisted of approximately 40 fruits. Several varieties were used, and in most experiments the fruits had been previously exposed to ethylene gas to predispose them to rapid stem-end decay. After treatment the fruits were held at 70° F. for several weeks before examination.

The explanation for the effectiveness of three of the materials found to date may lie in certain similarities of chemical structure. It appears that the presence of both an amino group and sulfur is essential for fungicidal activity in these compounds. Thiourea, previously reported on, is effective, while urea is ineffective. Both compounds carry amino groups, but the effective one carries in addition divalent sulfur. Thioacetamide (Table 1) is effective, while thioacetic acid is not. In this case both compounds carry sulfur, but the effective one carries in addition an amino group. The compound 2-aminothiazole also satisfies this criterion and is effective (Table 1). Thiourea in water solution is reported to tautomerize to the thiol form;[4] if so, it is probable that thioacetamide and 2-aminothiazole do likewise. Cristol *et al.*[2] maintain, however, that the thiol form does not exist in neutral aqueous solution and that $S=C(NH_2)$ and $HN=C(NH_2)$ are the only possible forms. It is not possible at this time to state whether the toxicity noted in these thio-amino compounds is due to the presence of a thiol form or a ring form.

To the best of our knowledge the compounds studied may also require considerable toxicity investigation before they can be accepted for use in the treatment of fruits. Since, however, they are effective and since it is possible that their toxicity may be of such order that they would be preferable to thiourea, we feel the data concerning their effectiveness should be presented for consideration by those interested in this problem.

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1 J. F. L. Childs and E. A. Siegler, *Phytopathology*, 34(11): 983–985, 1944.

2 P. Cristol, R. Seigneurin and J. Fourcade, *Compt. Rend.*, 200: 2223–5, 1935; *Chem. Abst.*, 29: 7159–9, 1935.

3 W. M. Hoskins, H. P. Bloxham and Marian W. Van Ess, *Jour. Econ. Ent.*, 33(6): 875–881, 1941.

4 H. Rivier and James Borel, *Helv. Chim.*, Acta II, 1219–1228, 1928.

5 George A. Zentmyer, *Phytopathology*, 32(1): 20, 1942.

THE ELECTRONIC BLANCHING OF VEGETABLES[1]

FOR their successful preservation by freezing or dehydration, vegetables are briefly exposed to flowing steam or boiling water. This heat treatment results in the inactivation of enzymes which may be respon-

1 Journal Paper No. 637, of the New York State Agricultural Experiment Station, Cornell University, Geneva, N. Y., June 4, 1945.