FUNGICIDES AS SAFENERS FOR LEAD ARSENATE ON APPLE FOLIAGE[1]

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Abstract

Fungicidal cover spray mixtures of captan or zineb and lead arsenate were relatively non-phytotoxic to 'Cortland' apple foliage. Ferbam did not consistently safen a mixture of glyodinand leadarsenate but, at a rate of 1 lb. per 100 gal., it reduced arsenical injury resulting from sprays of a dodine and lead arsenate mixture. Captan was more effective in safeningthe dodine-leadarsenate mixture in the first year of the test than in the second.

Introduction

Lead arsenate is widely used in Nova Scotia apple orchards for the control of the apple maggot and several lepidopterous pests. When used alone or in mixtures with certain fungicides it sometimes causes injury to apple foliage. This injury consists of necrotic areas of irregular shape varying in size from pinpoint to over 1 inch in diameter and is often accompanied by marginal necrosis. Apple varieties differ in their susceptibility to arsenical injury, 'Cortland' and 'Delicious' being very susceptible. Trees growing on light sandy soils also seem to be more susceptible than trees on heavier soils.

Some fungicides safen lead arsenate while others aggravate the injury or do not have any safening effect. In Nova Scotia spray mixtures containing glyodin and lead arsenate are very phytotoxic and mixtures of leadarsenate and dodine often cause foliage injury particularly if used in repeated applications. Palmiter (2) found that ferbam was a good safener for the glyodin-lead arsenate mixture and it has been generally recommended to apple growers for use as a safener for this mixture. In Nova Scotia severe foliage injury has often occurred with the glyodin-lead arsenate mixture even when ferbam was added as a safener. Since there has been no experimental work done in Nova Scotia on organic fungicides as correctives for arsenical injury a test was carried out in 1964 and 1965 on the use of fungicides as safeners for lead arsenate. The results are given in this paper.

Materials and methods

The mature apple trees used were the variety 'Cortland' located on light sandy soil. The trees were divided into 3 blocks each containing 8 plots. Each plot consisted of 4 trees. On the plots containing treatments 1, 6, 9 and 10 (Table 1) the 2 west trees were sprayed with the appropriate fungicide alone while the 2 east trees received the fungicides and lead arsenate. Treatments 4 and 5 were on the 2 west trees of the plots containing treatments 2 and 3, respectively. Treatments 7 and 8 were applied to all the trees in their respective plots. Except for treatments 4 and 5, the treatments were randomized within each block.

The sprays were applied dilute with a hand gun and the trees were sprayed to run-off. In both years, 1964 and 1965, the trees were sprayed 8 times with the fungicide and lead arsenate at 3 lb. per 100 gal. and the ferbam or captan safeners were added in the last 3 applications. These were applied at about 10-day intervals beginning near July 1. Prior to the lead arsenate treatments the plots containing treatments 1 to 5 and 6 to 8 were sprayed with dodine and glyodin, respectively, and those containing treatments 9 and 10 with captan.

The materials used were:

Dodine (Cyprex Dodine 65 - W), n dodecylguanidine acetate 65% (Cyanamid of Canada, Ltd., Rexdale, Ont.)

Glyodin (Crag Glyodin Solution Protective Fungicide), 2-heptadecyl-2-imidazoline acetate, 34% (Union Carbide Canada, Toronto, Ont.)

Captan (Captan 50 - W), N(trichloromethylthio) - 4 - cyclohexene - 1, 2 - dicarboximide, 50% (Stauffer Chemical Co., New York, N. Y.)

Zineb (Parzate C), zinc ethylene bisdithiocarbamate, 75% (DuPont Co. of Canada, Ltd., Montreal, P. Q.)

Ferbam (Fermate) ferric dimethyldithiocarbamate, 76% (DuPont Co. of Canada Ltd., Montreal, P.Q.)

Lead arsenate (Niagara Brand Chemicals, Burlington, Ont.)

In September the foliage of the trees in eachplot was rated for arsenic injury on a scale of 0-5, 0 being the foliage of trees with no arsenic injury and 5 being the most severely injured. At a rating of 5 about 50% of the leaves on the trees would have necrotic areas or marginal necrosis. With a rating of 1, there would only be a trace of injury and with a rating of 2, the injury would be light and not considered serious.

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Table 1. Arsenical injury on 'Cortland' apple foliage

Treatment and rate per 100 gal.	Arsenical injury rating* 1964	1965	Average
Lead arsenate, 3 lb. t			
1. dodine, ½ lb.	4.3	3.2	3.8
2. dodine, ½ lb. t ferbam, ½ lb.	1.7	3.2	2.4
3. dodine, ½ lb. t ferbam, 1 lb.	1.3	1.7	1.5
4. dodine, ½ lb. t captan, ¾ lb.	1.0	3.0	2.0
5. dodine, ½ lb. t captan, 1 lb.	1.5	2.0	1.8
6. glyodin, 1 qt.	4.7	3.5	4.1
7. glyodin, 1 qt. t ferbam, ½ lb.	4.2	2.7	3.4
8. glyodin, 1 qt. t ferbam, 1 lb.	3.5	1.5	2.5
9. captan, 1½ lb.	1.5	1.0	1.2
10. zineb, 2 lb.	1.0	1.5	1.2

* 0, no injury; 5, most severe.

Results and discussion

The results given in Table 1 are the average of the 3 replicates for each treatment. They show that there was considerable variation between years particularly with captan as a safener for the dodine-lead arsenate mixture. According to Hilborn et al. (1) lead arsenate is more injurious in hot dry summers. In this test the summer of 1965 was much drier than 1964. This climatic difference may account for the seasonal variation in results. There was little arsenical injury where captan and zineb were used alone with lead arsenate. Zineb is recommended in Nova Scotia as a final cover spray on apples for controlling late or pin-point scab. In recent tests in New York captan reduced the amount of blossom-end injury caused by lead arsenate (3, 4). There were no necrotic areas or marginal necroses where the fungicides were used without lead arsenate.

Ferbam was not generally effective as a safener for the glyodin-lead arsenate mixture, although at the 1 lb. rate in 1965 it did reduce the injury. Ferbam at the 1 lb. rate was fairly effective with the dodine-lead arsenate spray in both years. The lower rate of ½ lb. was effective for glyodin in New York (2) but apparently did not safen the mixture under the conditions of this test. Hilborn et al. (1) suggested that the safening effect of ferbam might be due to the absorption of iron by the leaf followed by an increase in the iron-manganese ratio. The variation between orchards in the susceptibility of apple trees to arsenical injury and the differences between here and elsewhere in the effect of ferbam as a safener may be due to differences in the iron-manganese ratio or other nutritional conditions.

Literature cited

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