

ARSENICAL INJURY TO APPLE FOLIAGE FROM SPRAY MIXTURES CONTAINING LEAD ARSENATE¹

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Abstract

Cover spray mixtures of captan and lead arsenate were relatively non-phytotoxic to 'Cortland' apple foliage. The amount of arsenical injury was increased when ryania was present in dodine-lead arsenate and captan-lead arsenate mixtures. Injury was not consistently reduced when zineb was added to lead arsenate or to a mixture of lead arsenate and dodine, glyodin, or ryania. Azinphos-methyl safened the mixture of dodine and lead arsenate in the first year it was tested but not in the second.

Introduction

In a previous paper, Ross and Sanford (2) reported on the efficacy of fungicides as safeners for lead arsenate on apple foliage. They found that lead arsenate was relatively non-phytotoxic in covers sprays of captan or zineb. Ferbam at the higher of two rates used was better than captan in safening a mixture of dodine and lead arsenate but it did not safen a mixture of glyodin and lead arsenate.

Further experiments have been done on the phytotoxicity to apple foliage of various pesticidal cover spray mixtures containing lead arsenate. Results obtained are presented in this paper.

Materials and methods

In 1966 and 1967 the same 'Cortland' apple trees and the same randomized block design of three replicates of 10 treatments were used as in previous work (2). Dilute sprays were applied with a hand gun and the trees were sprayed to run-off. Each year the trees were sprayed eight times, but the treatments containing lead arsenate (Table I) were applied only in the last three applications, at about 10-day intervals beginning near July 1. Prior to the lead arsenate treatments the plots receiving treatments 1 and 8 were sprayed five times with captan; treatments 2, 3, 4, and 5, with dodine; and treatments 6, 7, 9, and 10, with glyodin.

In 1968 and 1969 another orchard of mature 'Cortland' apple trees, located on light sandy soil was divided into three blocks, each containing seven

6-tree plots. Prior to the lead arsenate treatments the orchard was sprayed regularly with dodine. The treatments were put on as in 1966 and 1967 and consisted of the same number of applications applied at about the same times,

The materials used were:

Cyprex 65-W, dodine 6570. Cyanamid of Canada, Ltd., Rexdale, Ont.

"Crag" Glyodin Solution Protective Fungicide, glyodin, 34%. Union Carbide Canada Ltd., Toronto, Ont.

Captan 50-W, captan, 50%. Stauffer Chemical Co., New York, N.Y.

Parzate C, zineb, 75%. DuPont of Canada, Ltd., Montreal, P.Q.

Glyodex, dodine, 16.35% & glyodin, 50.09%. Green Cross Products, Montreal, Que.

Lead arsenate. Niagara Brand Chemicals, Burlington, Ontario.

Ryanicide 50 WP, ryania (powdered stem of *Ryania speciosa*), 50%. S.B. Penick and Co., New York, N.Y.

Guthion 25-W, azinphos-methyl, 25%. Niagara Brand Chemicals, Burlington, Ontario

In September the foliage of each tree in each plot was rated for arsenical injury on a scale of 0 to 5, 0 being the foliage of trees with no arsenical injury and 5 being the most severely injured. At a rating of 5 about 50% of the leaves on a tree would have necrotic areas or marginal necrosis. With a rating of 1, there would be only 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 apple foliage in 1966 and 1967

Treatment and rate per 100 gal	Arsenical injury*		
	1966	1967	Avg
Lead arsenate, 3.0 lb t			
1. captan, 50%, 1.5 lb	0.6	1.0	0.8
2. dodine, 65%, 0.5 lb	1.8	1.8	1.8
3. dodine, 65%, 0.5 lb t zineb, 75%, 0.5 lb	2.4	1.0	1.7
4. dodine, 65%, 0.5 lb t captan, 50%, 0.5 lb	0.8	1.7	1.2
5. dodine, 65%, 0.5 lb t ryania, 50%, 6.0 lb	2.3	3.5	2.9
6. glyodin, 34%, 1.0 qt (Imp.)	1.8	4.3	3.0
7. glyodin, 34%, 1.0 qt + zineb, 75%, 0.5 lb	2.6	1.8	2.2
8. zineb, 75%, 2.0 lb	1.7	0.3	1.0
9. Glyodex [†] , 0.5 lb	2.4	3.3	2.8
10. Glyodex [†] , 0.5 lb t zineb, 75%, 0.5 lb	1.3	2.5	1.9

* 0 = no injury; 5 = most severe injury.

† Glyodex contains dodine, 16.35%, and glyodin, 50.09%.

Results and discussion

The results given in Tables 1 and 2 are the average of the three replicates for each treatment in each year. The variation among years agrees with a previous test (2). Mixtures of glyodin and lead arsenate are usually very phytotoxic but in 1966 they caused little injury (Fig. 1). In 1967 they were the most phytotoxic of the treatments. Previously (2) zineb was considered to be a good safener, but its effectiveness apparently varies from year to year whether used with lead arsenate alone or with lead arsenate in combination with other fungicides.

In cover sprays ryania and lead arsenate are often used together to control the codling moth and apple maggot, respectively. Adding ryania to the fungicide-lead arsenate mixture increased the amount of arsenical injury more with dodine as the fungicide than with captan or zineb. In 1968 azinphos-methyl, which is used for codling moth control, safened dodine and lead arsenate, but it was not as effective in 1969.

Captan appears to be the most reliable safener for lead arsenate, particularly when the mixture

contains ryania (Table 2). Here (Table 1) and in previous work (2), captan at 0.5 lb/100 gal has also been fairly effective as a safener for a dodine-lead arsenate mixture. In Nova Scotia zineb is considered to be more effective than captan as a final cover spray on apples for the control of late or pin-point

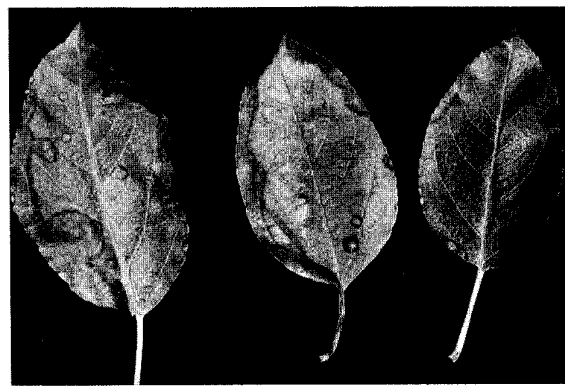


Figure 1. Arsenical injury on leaves of 'Cortland' apple.

Table 2. Arsenical injury on apple foliage in 1968 and 1969

Treatment and rate (lb/100 gal)	Arsenical injury*		
	1968	1969	Avg
<u>Lead arsenate, 3.0 t</u>			
1. captan, 50%, 1.5	1.3	1.6	1.5
2. captan, 50%, 1.5 t ryania, 50%, 6.0	1.7	2.2	1.9
3. dodine, 65%, 0.5	2.4	2.8	2.6
4. dodine, 65%, 0.5 t ryania, 50%, 6.0	3.5	3.3	3.4
5. dodine, 65%, 0.5 t azinphos-methyl, 25%, 1.0	1.1	2.4	1.7
6. zineb, 75%, 2.0	2.7	2.3	2.5
7. zineb, 75%, 2.0 t ryania, 50%, 6.0	2.9	3.2	3.0

* 0 = no injury; 5 = most severe injury.

sect. The results here show that it is not always an effective safener for lead arsenate, although this might depend on the orchard in which it is used. The tests in which it was not too effective (Table 2) were conducted in a different orchard than the one from which the results reported in Table 1 and in previous work (2) were obtained. The pre-treatment sprays schedules also differed in the two orchards.

The variability of results between orchards and among seasons may be due to the pre-lead arsenate spray program or, as has been suggested before (2), to the nutritional status of the orchard and climatic conditions. In Nova Scotia arsenical injury rarely occurs in orchards on the heavier soils. July and August of 1968 and 1969 were drier than normal and, except where azinphos-methyl was used, the results were quite similar for the 2 years. Rainfall for these 2 months in 1966 was 2.6 inches less than for

the same period in 1967 and there was considerable variation in the 2 years' results. According to Hilborn et al. (1) lead arsenate is more injurious in hot dry summers. The results here suggest that the seasonal effect may also vary with the components of the spray mixture in which lead arsenate is used.

Literature cited

1. Hilborn, M.T., L.W. Boulanger, and G.R. Cooper. 1958. The effect of some pesticides on the chemical composition of McIntosh apple leaves. *Plant Dis. Repr.* 42:776-777.
2. Ross, R.G., and K.H. Sanford. 1966. Fungicides as safeners for lead arsenate on apple foliage. *Can. Plant Dis. Surv.* 46:90-91.